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aXonica: A support package for MRI based Neuroimaging

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ABSTRACT

Magnetic Resonance Imaging (MRI) assists in studying the nervous system. MRI scans undergo significant processing before presenting the final images to medical practitioners. These processes are executed with ease due to excellent software pipelines. However, establishing software workstations is non-trivial and requires researchers in life sciences to be comfortable in downloading, installing, and scripting software that is non-user-friendly and may lack basic GUI. As researchers struggle with these skills, there is a dire need to develop software packages that can automatically install software pipelines speeding up building software workstations and laboratories. Previous solutions include NeuroDebian, BIDS Apps, Flywheel, QMENTA, Boutiques, Brainlife and Neurodesk. Overall, all these solutions complement each other. NeuroDebian covers neuroscience and has a wider scope, providing only 51 tools for MRI. Whereas, BIDS Apps is committed to the BIDS format, covering only 45 software related to MRI. Boutiques is more flexible, facilitating its pipelines to be easily installed as separate containers, validated, published, and executed. Whereas, both Flywheel and Qmenta are propriety, leaving four for users looking for 'free for use' tools, i.e., NeuroDebian, Brainlife, Neurodesk, and BIDS Apps. This paper presents an extensive survey of 317 tools published in MRI-based neuroimaging in the last ten years, along with 'aXonica,' an MRI-based neuroimaging support package that is unbiased towards any formatting standards and provides 130 applications, more than that of NeuroDebian (51), BIDS App (45), Flywheel (70), and Neurodesk (85). Using a technology stack that employs GUI as the front-end and shell scripted back-end, aXonica provides (i) 130 tools that span the entire MRI-based neuroimaging analysis, and allow the user to (ii) select the software of their choice, (iii) automatically resolve individual dependencies and (iv) installs them. Hence, aXonica can serve as an important resource for researchers and teachers working in the field of MRI-based Neuroimaging to (a) develop software workstations, and/or (b) install newer tools in their existing workstations.

1. Introduction

Neuroimaging is the study of the nervous system using imaging. It employs (i) Magnetic Resonance Imaging (MRI), (ii) Computed Tomography (CT) scan, (iii) Positron Emission Tomography (PET), (iv) Magnetoencephalography and Electroencephalography (MEG/EEG) to study the nervous system.[1–4]

MRI has three broad types with reference to the nervous system. They are (a) structural MRI (sMRI), which highlights anatomical and pathological detail, (b) functional MRI (fMRI) detects changes in blood-oxygen-levels as a surrogate to measure brain activity, and (c) Diffusion-Weighted MRI (dMRI) traces white-matter fiber tracts via the diffusion process of water molecules.[5–7]

Regardless of their type, MRI scans undergo an extensive processing pipeline before being presented to medical practitioners. These pipelines are executed using a variety of computational tools. These tools help speed-up clinical diagnosis but also compel biologists to spend an increasing amount of time and resources in installing, configuring, and maintaining software. Moreover, some tools assume that the users are comfortable with scripting. However, many users in life sciences are not. Therefore, as scientists in life sciences struggle with these skills, there is a need to develop software that automatically installs and configures

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entire analysis pipelines.[8–14]

In general, students and colleagues in life-sciences excel in wet-lab, yet, their skills in in-silico lab are limited.[15–18] Interestingly, students in high-income countries also face similar challenges.[19] Therefore, there is a common problem that is growing across science, including Neuroimaging, which is the inevitable and constantly growing dependence on an ever expanding, and increasingly sophisticated set of analysis tools. While recent software are very useful, allowing users to perform tasks that were previously very difficult, the ever increasing complexity and maintenance often overwhelms the users. Interestingly, while these software increases productivity when things are working, they also decrease productivity due to the time spent maintaining them and learning their use. In general, 'ease-of-use' has a positive impact on the end user,[20] the same goes in bioinformatics,[21,22] hence the need to a range of solutions catering to different research domains, facilitating the end-user, one of which is presented in this research paper.

Therefore, this paper presents 'aXonica,' an installation package that is (a) easy to use, (b) GUI-based, (c) allows the user to select 130 tools along the entire MRI based Neuroimaging analysis, and (d) automatically resolves individual dependencies of software, akin to popular approaches to install software such as Play Store, Apple Store, and Window's or Ubuntu's software centre. Hence, aXonica facilitates building software workstations and laboratories for research and teachers engaged in MRI-based Neuroimaging. The tool itself (aXonica) derives its name from the 'axon,' i.e., the nerve fiber carrying electrical impulses for neurons.

Hereinbelow, Section 2 discusses previous similar works in the domain of Neuroinformatics. Section 3 presents the methods employed in developing aXonica, while Sections 4 and 5 provides detailed results, pitfalls, and discussions leading to Section 6 where the authors conclude by presenting a summary of their contribution.

2. Related works

aXonica provides neuroinformatics researchers a software package that easily installs 130 tools by automatically resolving their dependencies and allowing users to choose which software works best for them. Other similar efforts employed Docker containers, virtual machines, and cloud frameworks, notable of whom are NeuroDebian,[23] BIDS app,[24] Flywheel,[25] Qmenta,[26] Boutiques,[27] Brainlife,[28] and Neurodesk.[29] Table 1 provides a brief comparison between these solutions.

NeuroDebian encapsulates 51 popular neuroimaging tools installed using the Debian/Ubuntu package management system (PMS),[23,24] and may be considered a precursor to aXonica. It however, offers little in both portability and reproducibility.[29]

BIDS Apps is an image of a neuroimaging pipeline that employs Brain Imaging Data Structure (BIDS) as an input. It is portable and runs on all three major operating systems (Linux, Windows, and macOS) without the need for complicated setup and configuration because all binaries and associated dependencies are packaged in one container engine.[24] Since its start in 2017, as many as 45 applications have used the BIDS standard, collectively referring to this ecosystem as 'BIDS Apps.' Since its deployment, BIDS format is slowly gaining traction, becoming the standard for neuroimaging.[24]

Another addition, Boutiques helps automate publishing, integrating, and executing command-line applications across computational platforms. It is both compatible with BIDS App, and complements it. While BIDS Apps standardizes neuroimaging application interfaces, Boutiques describes them as flexibly as possible,[27] allowing for configuring and running tool containers on local machines.[30] Moreover, Boutiques pipeline descriptor can be stored on Zenodo, and identified by a permanent Digital Object Identifier (DOI). Therefore, Through the Boutiques command line, the pipelines can be validated, installed, published, and executed.[31]

Both Flywheel[25] and QMENTA[26] are cloud-based propriety frameworks for curating and analyzing medical imaging data. Both allow significant ease-of-use, as they can be accessed using a browser, eliminating the need to install and maintain software. Here, a number of proprietary, open-source, and licensed tools are available. Flywheel shows 70 tools in its cloud framework, while the information on the number of applications available on QMENTA is not available (at the time of the manuscripts submission). QMENTA is also reported to lack normative reference data.[32]

Lastly, both Brainlife[28] and Neurodesk[29] are recent additions to the neuroimaging ecosystem. Brainlife is an open-source cloud based platform for MRI, EEG and MEG-based neuroimaging boasting 206 tools for all modalities (MRI, EEG, MEG) of neuroimaging with additional 329 snippets. While Neurodesk comprises 85 tools to date (2024).[29] Please refer to Table 1 for a comparison of the above mentioned solutions.

3. Methods

The following series of steps define the methodology of our research:

Step 1: **Tools:** Collect all tools related to Neuroimaging based MRI.
Step 2: **Selection Criterion:** Select software that is (a) recent (published after 2012), (b) free (employ a freeware license), (c) Linux-based, and (d) functions offline. In addition, (e) tools that are published before 2012 and have been cited more than 100 times, and (f) tools that are based on MATLAB that fulfill the criteria (a) to (e) are also incorporated.
Step 3: **Information:** For tools selected in Step 2, determine download size, date of the last update, and recent most version.
Step 4: **Shell Scripting:** Develop separate shell files for each of the selected tools. The shell script should automatically (a) download the software, (b) resolve all dependencies, and (c) install the software.
Step 5: **GUI:** Make a front-end GUI that allows the user to (a) select tools, (b) automatically resolve associated dependencies, and (c) install selected tools.

Table 1
The table compares aXonica with similar solutions. Here, 'W' denotes Windows, 'M' stands for Mac OS, 'L' represents Linux, and 'U' specifically denotes Ubuntu. Items marked as '-' means the information is unavailable at the time of submission of this manuscript.

S.No.	Evaluation metrics	aXonica 4.0	NeuroDebian	BIDS Apps	Flywheel	QMENTA	Boutiques	Brainlife	Neurodesk
1	No. of Tools	**130**	51	45	70	–	–	206	85
2	Operating Systems	U, W, M	L, W, M	U, W, M	W, M, L	W, M, L	L, W, M	L, W, M	L, W, M
3	Frame-work	Shell, Yad & Zenity	Debian PMS	Container	Cloud	Cloud	Container	Cloud	Container
4	Updated (post 2021)	✓	×	✓	✓	✓	✓	✓	✓
5	Complete Analysis Pipeline	✓	×	✓	✓	✓	✓	✓	✓
6	No Space Limitations	✓	×	✓	✓	✓	✓	✓	✓
7	User Friendly	✓	✓	✓	✓	✓	✓	✓	✓
8	sMRI/fMRI/dMRI	✓	✓	✓	✓	✓	✓	✓	✓
9	MATLAB support	✓	–	–	–	–	–	–	–
10	Transparent	✓	✓	×	✓	✓	✓	✓	✓
11	Reproducible analysis pipeline	✓	×	✓	✓	✓	✓	✓	✓

4. Results

The following enumerated points follow step-by-step the methodology defined in the previous section:

Point 1: **Tools:** The authors surveyed existing literature to collect a wholesome 318 software related to MRI-based neuroimaging.
Point 2: **Selection Criterion:** Selected a total of 130 tools out of 318 which were (i) recent (published after 2012), (ii) free for academic use, (iii) Linux-based, (iv) worked offline, and (v) were popular (showed high citation count). Fig. 1, Tables 3 and 4 presented within

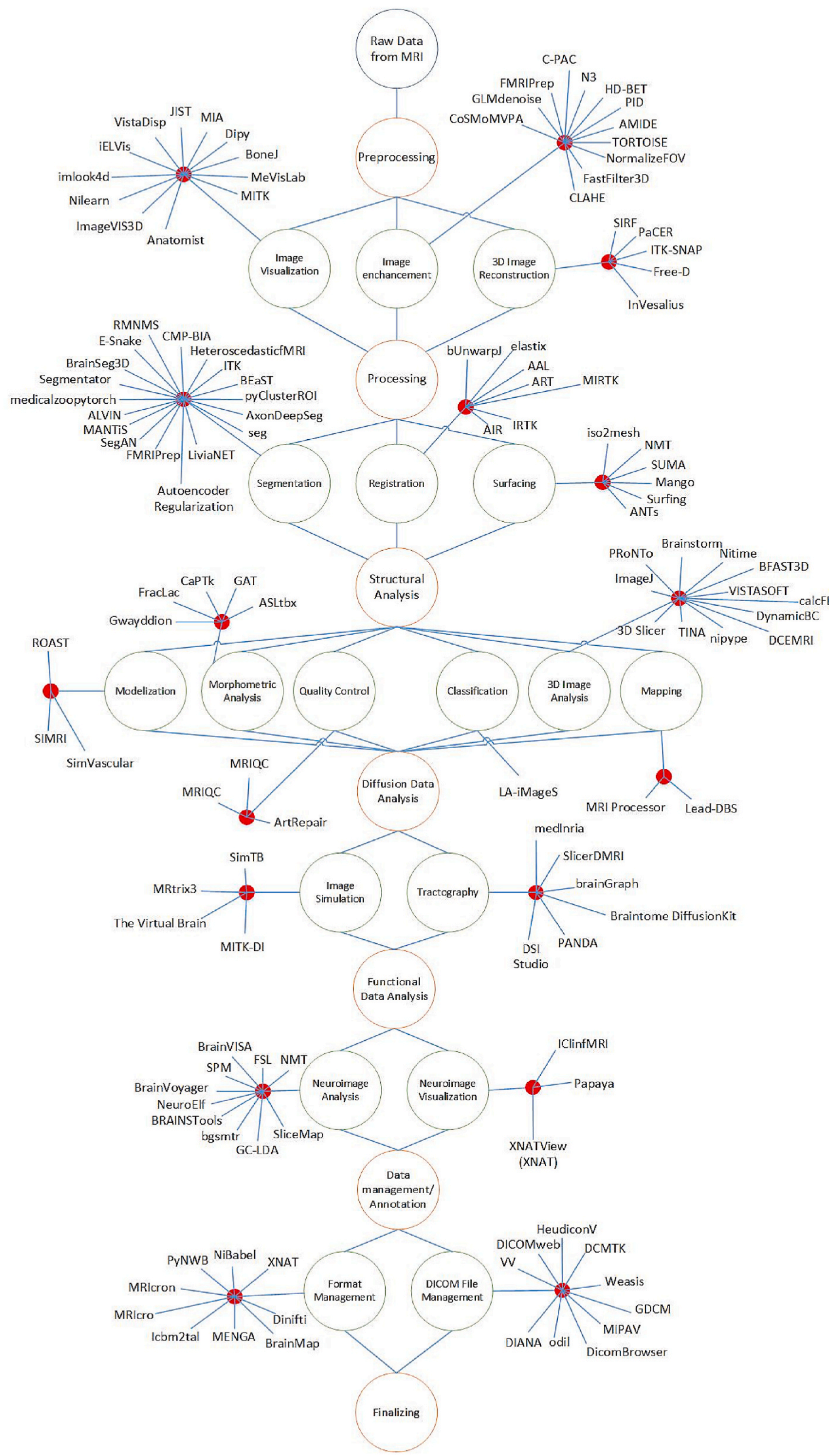


Fig. 1. The figure presents a MRI data analysis pipeline showcasing the different tools included in aXonica grouped by functionality.

Table 2
The table surveys an exhaustive list of 317 tools developed by the community to facilitate MRI practices. Subsequent columns show a selection criterion for choosing tools that are free, offline and published after 2012. Software that fulfill the criteria are selected and coupled together in aXonica.

No.	Software Tool Names	Pub. Date (2012+)	Free	Linux based	Offline	Cited (Nov. 2021)	Installed
Image Pre-processing							
Image Visualization							
1	3D-DOCTOR ([33])	×	×	×	✓	103	×
2	AFQ-Browser ([34])	✓	✓	✓	×	0	×
3	AnalyzefMRI ([35])	✓	✓	✓	✓	4	×
4	Anatomist (BrainVISA) ([36])	✓	✓	✓	✓	138	✓
5	BioImage Suite ([37])	×	✓	✓	×	154	×
6	BioMap ([38])	✓	×	✓	×	97	×
7	BoneJ ([39])	✓	✓	✓	✓	1845	✓
8	BrainMaker ([40])	✓	×	✓	✓	70	×
9	BRANT ([41])	✓	✓	✓	✓	7	×
10	CereVA ([42])	✓	✓	✓	✓	2	×
11	Dipy ([43])	✓	✓	✓	✓	405	✓
12	Dynamic Reslice ([44])	×	✓	✓	✓	12	×
13	ezDICOM ([45])	✓	✓	×	✓	18	×
14	FiberWeb ([46])	×	×	✓	×	2	×
15	HeartVista ([47])	✓	×	✓	✓	44	×
16	iELVis ([48])	✓	✓	✓	✓	50	✓
17	IGSTK ([49])	×	✓	✓	✓	101	✓
18	ImageVIS3D ([50])	×	✓	✓	✓	6	✓
19	imlook4d ([51])	✓	✓	✓	✓	47	✓
20	JIST ([52])	×	✓	✓	✓	139	✓
21	JIV ([53])	×	✓	✓	✓	6	×
22	JIV2 ([53])	×	✓	✓	✓	6	×
23	Materialize Mimics ([54])	✓	×	×	✓	20	×
24	MeVisLab ([55])	✓	✓	✓	✓	31	✓
25	MIA ([56])	✓	✓	✓	✓	36	✓
26	MITK ([57])	×	✓	✓	✓	374	✓
27	MRIstudio ([58])	×	✓	×	✓	81	×
28	MultiTracer 2 ([59])	×	×	✓	✓	55	×
29	Nilearn ([60])	✓	✓	✓	✓	368	✓
30	NmrLineGuru ([61])	✓	✓	✓	✓	0	×
31	OsiriX ([62])	×	×	×	✓	1885	×
32	ParaVision ([63])	×	×	×	✓	2	×
33	ScAnVP ([64])	×	✓	×	✓	99	×
34	SkullyDoo ([65])	×	✓	✓	✓	22	×
35	TissueMaker ([66])	✓	×	×	✓	13	×
36	TUNNEX ([67])	✓	✓	✓	✓	5	×
37	VisBio ([68])	×	✓	✓	✓	49	×
38	Visible Patient ([69])	✓	✓	×	✓	10	×
39	VolView ([70])	×	✓	✓	✓	20	×
40	VoxBlast ([71])	×	✓	✓	✓	2	×
41	Xepr ([72])	×	×	✓	✓	409	×
Image Enhancement							
42	ACID ([73])	✓	×	✓	×	6	×
43	AMIDE ([74])	×	✓	✓	✓	851	✓
44	Analyze ([35])	×	×	✓	✓	337	×
45	Aws4SPM ([75])	×	✓	✓	✓	0	×
46	BET (FSL) ([76])	×	✓	✓	✓	8134	✓
47	BROCCOLI ([77])	✓	✓	✓	✓	60	✓
48	CLAHE ([78])	×	✓	✓	✓	172	✓
49	CoSMoMVPA ([79])	✓	✓	✓	✓	152	✓
50	C-PAC ([80])	✓	✓	✓	✓	60	✓
51	DL identifies MRI contrast ([81])	✓	✓	✓	✓	4	×
52	FastFilter3D ([82])	×	✓	✓	✓	14	✓
53	Fiswidgets ([83])	×	✓	✓	✓	77	×
54	FMRIPrep ([84])	✓	✓	✓	✓	161	✓
55	GLMdenoise ([85])	✓	✓	✓	✓	17	✓
56	HDR-MRI ([86])	✓	✓	✓	✓	43	×
57	ICN_Atlas ([87])	✓	✓	✓	✓	1	×
58	MINC ([88])	×	✓	✓	✓	31	×
59	MNI-N3([89])	×	✓	✓	✓	4141	✓
60	NIAK ([90])	×	✓	✓	✓	31	×
61	NormalizeFOV ([91])	✓	✓	✓	✓	4	✓
62	PID - Parallel iterative deconvolution ([92])	×	✓	✓	✓	0	×
63	SFSRR ([93])	×	✓	✓	✓	101	✓
64	TORTOISE ([94])	×	✓	✓	✓	195	✓
3D Image Reconstruction							
65	AMILab ([95])	✓	✓	✓	✓	3	×
66	AnalyzePro ([96])	×	×	✓	✓	0	×
67	BART ([97])	✓	✓	✓	✓	2	×
68	DCGAN ([98])	✓	✓	✓	✓	0	×
69	Fetal Reconstruction ([99])	✓	✓	✓	✓	124	✓

(continued on next page)

Table 2 (*continued*)

No.	Software Tool Names	Pub. Date (2012+)	Free	Linux based	Offline	Cited (Nov. 2021)	Installed
70	Free-D ([100])	×	✓	✓	✓	66	✓
71	Gadgetron ([101])	✓	✓	✓	✓	253	×
72	InVesalius ([102])	✓	✓	✓	✓	27	✓
73	ITK-SNAP ([103])	×	✓	✓	✓	4079	✓
74	PaCER ([104])	✓	✓	✓	✓	88	✓
75	PRIM ([105])	✓	✓	✓	✓	4	×
76	SIRF ([106])	✓	✓	✓	✓	20	✓
Image Processing							
Image Segmentation							
77	AganjEtAl2018 ([107])	✓	✓	✓	✓	13	×
78	ALI ([108])	✓	✓	✓	✓	19	×
79	ALVIN ([109])	✓	✓	✓	✓	80	✓
80	Autoencoder Regularization ([110])	✓	✓	✓	✓	391	✓
81	AxioVision ([111])	✓	×	×	✓	8	×
82	AxonDeepSeg ([112])	✓	✓	✓	✓	51	✓
83	BEaST ([113])	✓	✓	✓	✓	287	✓
84	BrainSeg3D ([114])	✓	✓	✓	✓	1	✓
85	CMB detection ([115])	✓	✓	✓	✓	4	×
86	CMP-BIA ([116])	✓	✓	✓	✓	227	✓
87	ELV ([117])	✓	✓	✓	✓	2	×
88	E-Snake ([118])	✓	✓	✓	✓	56	✓
89	FMRIPrep ([84])	✓	✓	✓	✓	96	✓
90	GC/Graph Cut ([119])	×	×	×	×	483	×
91	GIFT ([108])	×	✓	✓	✓	185	×
92	HAMMER ([120])	✓	✓	✓	✓	31	✓
93	HeteroscedasticfMRI ([121])	✓	✓	✓	✓	9	✓
94	iCafe ([122])	✓	×	✓	✓	13	×
95	ITK ([123])	×	✓	✓	✓	607	×
96	LiviaNET ([124])	✓	✓	✓	✓	285	✓
97	LOCUS ([125])	×	×	✓	✓	27	×
98	LOTS-IAM ([126])	✓	✓	✓	✓	17	×
99	MANTiS ([127])	✓	✓	✓	✓	50	✓
100	medicalzoopytorch ([128])	✓	✓	✓	✓	91	✓
101	MeshNET ([129])	✓	✓	✓	✓	79	×
102	MIMoSA ([130])	✓	✓	✓	✓	16	×
103	Plastimatch ([131])	×	✓	×	✓	47	×
104	pyClusterROI ([132])	✓	✓	✓	✓	923	✓
105	RMNMS ([133])	✓	✓	✓	✓	68	✓
106	seg ([107])	✓	✓	✓	✓	48	✓
107	SegAN ([134])	✓	✓	✓	✓	115	✓
108	Segmentator ([135])	✓	✓	✓	✓	19	✓
109	VNet ([109])	✓	✓	✓	✓	1472	×
Image Registration							
110	AAL ([136])	✓	✓	✓	✓	144	✓
111	AIR ([137])	×	✓	✓	✓	1967	✓
112	ART ([138])	✓	✓	✓	✓	725	✓
113	ATRA ([139])	✓	✓	✓	✓	0	×
114	bUnwarpJ ([140])	✓	✓	✓	✓	23	✓
115	CerebroMatic ([141])	✓	×	✓	✓	8	×
116	Deep QC ([142])	✓	✓	✓	✓	2	×
117	elastix ([143])	✓	✓	✓	✓	230	✓
118	Evaluation of similarity measures ([144])	×	✓	✓	×	117	×
119	IBASPM ([145])	×	✓	✓	✓	241	×
120	IntrAnat Electrodes ([146])	✓	✓	✓	✓	2	×
121	IRTK ([147])	×	✓	✓	✓	148	✓
122	MIRTK ([148])	×	✓	✓	✓	357	✓
123	MRI2MRI ([149])	✓	✓	✓	×	0	×
124	MRTool ([150])	✓	✓	×	✓	4	×
125	msi-register ([151])	✓	✓	✓	✓	14	×
126	MSM ([152])	×	✓	✓	×	188	×
127	pyDBS ([153])	×	✓	✓	✓	37	×
128	ROMEO ([154])	×	✓	✓	✓	162	×
129	sb-reg ([155])	✓	✓	✓	✓	10	×
Image Surfacing							
130	3DimViewer ([156])	✓	✓	×	✓	2	×
131	ANTs ([157])	×	✓	✓	✓	1590	✓
132	caret ([158])	×	✓	✓	✓	1145	×
133	Interactive 3D Surface Plot ([159])	×	✓	✓	✓	0	×
134	iso2mesh ([160])	×	✓	✓	✓	556	✓
135	Mango ([161])	✓	✓	✓	✓	48	✓
136	MRIcroS ([162])	×	✓	✓	✓	291	×
137	Simpleware ScanIP ([163])	✓	×	×	✓	110	×
138	SUMA ([164])	×	✓	✓	✓	131	✓
139	SureFit ([158])	×	✓	✓	✓	1145	×
140	Surfing ([165])	×	✓	✓	✓	113	✓
141	SurfRelax ([166])	×	✓	✓	✓	45	×

(*continued on next page*)

Table 2 (*continued*)

No.	Software Tool Names	Pub. Date (2012+)	Free	Linux based	Offline	Cited (Nov. 2021)	Installed
Structural Data Analysis							
3D Image Analysis							
142	3D Slicer ([167])	×	✓	✓	✓	622	✓
143	AETF ([168])	✓	✓	✓	✓	1	×
144	BFAST3D ([169])	✓	✓	✓	✓	24	✓
145	BrainsMapi ([170])	✓	✓	✓	✓	20	×
146	Brainstorm ([171])	×	✓	✓	✓	1280	✓
147	calcFD ([172])	✓	✓	✓	✓	43	✓
148	DCEMRI ([173])	×	✓	✓	✓	91	✓
149	DynamicBC ([174])	✓	✓	✓	✓	58	✓
150	Fast-FineCut ([175])	✓	✓	✓	✓	0	×
151	ImageJ ([176])	✓	✓	✓	✓	1045	✓
152	MammoApplet ([177])	✓	✓	✓	✓	11	×
153	nipype ([178])	×	✓	✓	✓	530	✓
154	Nitime ([179])	✓	✓	✓	✓	16	✓
155	PRoNTo ([180])	✓	✓	✓	✓	270	✓
156	ProstateAnalyzer ([181])	✓	✓	✓	✓	6	×
157	QMRITools ([182])	✓	✓	✓	✓	12	×
158	SC-OCTA ([183])	✓	✓	×	✓	14	×
159	SPLASh ([184])	×	✓	✓	✓	10	×
160	SSSuperPCA ([185])	✓	✓	✓	✓	0	×
161	Tetrahydra ([135])	✓	✓	✓	✓	7	×
162	TINA ([186])	✓	✓	✓	✓	30	✓
163	TIVMI ([187])	✓	✓	×	✓	2	×
164	VISTASOFT ([188])	✓	✓	✓	✓	38	✓
165	WaveIDioT ([189])	×	✓	✓	✓	1	×
166	ZhaoEtAl2018 ([190])	✓	×	✓	✓	3	×
Morphometric Analysis							
167	Arcana ([191])	✓	✓	✓	✓	1	×
168	ASLtbx ([192])	✓	✓	✓	✓	94	✓
169	bNets ([193])	✓	✓	✓	✓	6	×
170	CaPTk ([194])	✓	✓	✓	✓	27	✓
171	CIVET ([195])	✓	×	✓	×	12	×
172	FracLac ([196])	✓	✓	✓	✓	123	✓
173	GAT ([197])	✓	✓	✓	✓	202	✓
174	gr-MRI ([198])	✓	✓	✓	✓	18	×
175	Gwyddion ([199])	✓	✓	✓	✓	1712	✓
176	MiMSeg ([200])	✓	×	✓	×	7	×
177	Mindboggle ([201])	×	✓	✓	✓	321	×
178	NAPR ([202])	✓	✓	✓	✓	9	×
179	VolPack ([203])	×	✓	✓	✓	39	×
180	VPV ([204])	✓	✓	✓	✓	4	×
Quality Control							
181	AQuA[205]	×	✓	✓	✓	0	×
182	ArtRepair ([206])	×	✓	✓	✓	133	✓
183	BrainWeb ([207])	×	✓	✓	×	712	×
184	CAT ([208])	×	✓	✓	✓	1	×
185	DPABI ([209])	✓	✓	✓	✓	3	×
186	Galaxy ([210])	✓	✓	✓	✓	0	×
187	Mindcontrol ([211])	✓	✓	✓	✓	27	✓
188	MRIQC ([212])	✓	✓	✓	✓	87	✓
189	MRQy ([213])	✓	✓	✓	✓	10	×
190	Pre. Conn. Project ([214])	✓	✓	✓	✓	45	×
191	Qoala-T ([215])	✓	✓	✓	✓	83	×
Image Modelization							
192	breast-body-fusion ([216])	✓	✓	✓	✓	4	×
193	Cortex ([217])	×	✓	✓	✓	411	×
194	ICMA ([218])	✓	✓	✓	✓	4	×
195	IMOD ([219])	×	✓	✓	✓	3401	×
196	NiftySim ([220])	✓	✓	✓	✓	50	✓
197	ROAST ([221])	✓	✓	✓	✓	32	✓
198	SIMRI ([222])	×	✓	✓	✓	198	✓
199	SimVascular ([223])	✓	✓	✓	✓	23	✓
200	Template-O-Matic ([224])	×	✓	✓	✓	362	×
201	vmtk ([225])	×	✓	✓	✓	36	×
Image Classification							
202	BrainSuite([226])	✓	✓	✓	×	36	×
203	LA-iMageS ([227])	✓	✓	✓	✓	17	✓
204	MANIA ([228])	✓	✓	✓	✓	14	✓
205	NeuroMTL iSEG ([229])	✓	✓	✓	✓	1	✓
Image Mapping							
206	Lead-DBS ([230])	✓	✓	✓	✓	44	✓
207	MRI Processor ([231])	✓	✓	×	✓	2	✓
Diffusion Data Analysis							
Image Simulation							
208	BAX ([232])	×	✓	✓	✓	5	×

(*continued on next page*)

Table 2 (*continued*)

No.	Software Tool Names	Pub. Date (2012+)	Free	Linux based	Offline	Cited (Nov. 2021)	Installed
209	MITK-DI ([233])	✓	✓	✓	✓	58	✓
210	Neurosynth ([229])	×	✓	✓	×	1616	×
211	SimTB ([234])	×	✓	✓	✓	144	✓
212	The Virtual Brain ([235])	✓	✓	✓	✓	182	✓
Tractography							
213	Amira ([236])	×	×	✓	✓	192	×
214	brainGraph ([237])	✓	✓	✓	✓	28	✓
215	Braintome DiffusionKit ([238])	✓	✓	✓	✓	14	✓
216	Camino ([239])	×	✓	✓	✓	4	×
217	Csaodf-hough ([240])	×	✓	✓	✓	375	×
218	cuDIMOT ([241])	✓	✓	✓	✓	55	×
219	DoDTI ([242])	✓	×	✓	✓	14	×
220	DSI Studio ([243])	✓	✓	✓	✓	44	✓
221	DTI-TK ([239])	✓	✓	✓	✓	4	×
222	DTK ([244])	✓	✓	✓	✓	604	×
223	ExploreDTI ([245])	✓	✓	✓	×	914	×
224	FiberNET ([246])	✓	×	✓	✓	8	×
225	medInria ([247])	✓	✓	✓	✓	142	✓
226	MRtrix3 ([248])	✓	✓	✓	✓	5	✓
227	PANDA ([249])	✓	✓	✓	✓	307	✓
228	SIFT ([250])	×	✓	✓	×	1616	×
229	SlicerDMRI ([251])	✓	✓	✓	✓	27	✓
230	TIP ([252])	×	✓	✓	✓	7	×
231	TrackVis ([253])	✓	✓	✓	✓	20	×
Functional Data Analysis							
Neuroimage Analysis							
232	AICHA ([254])	✓	×	✓	✓	154	×
233	bgsmtr ([255])	✓	✓	✓	✓	27	✓
234	BRAINSTools ([256])	×	✓	✓	✓	51	✓
235	BrainVISA ([36])	✓	✓	✓	✓	138	✓
236	BrainVoyager ([257])	✓	✓	✓	✓	160	✓
237	CBRAIN ([258])	✓	✓	✓	×	156	×
238	CONN ([259])	✓	✓	✓	✓	2699	✓
239	FMRLAB ([260])	×	✓	✓	×	4	×
240	FSL ([261])	✓	✓	✓	✓	4958	✓
241	GC-LDA ([262])	✓	✓	✓	✓	35	✓
242	iPlan CMF ([263])	✓	×	✓	✓	0	×
243	JRD-Fluid ([264])	×	✓	✓	×	2248	×
244	LittleBrain ([265])	✓	✓	✓	✓	20	×
245	LIPSIA ([266])	×	✓	✓	✓	399	×
246	NeuroElf ([267])	✓	✓	✓	✓	301	✓
247	NeuroInfo ([268])	✓	×	✓	✓	4	×
248	NMT ([269])	✓	✓	✓	✓	33	✓
249	Porcupine ([270])	✓	✓	✓	✓	12	×
250	PrAGMATiC ([271])	✓	✓	✓	×	320	×
251	ScAnVP ([64])	✓	×	✓	✓	0	×
252	SliceMap ([272])	✓	✓	✓	✓	2	✓
253	SDM ([273])	✓	✓	✓	✓	5	✓
254	SPM ([274])	✓	✓	✓	✓	2879	✓
255	TGL-SCCA ([275])	✓	✓	✓	✓	0	×
256	Tissue Mapper ([276])	✓	×	×	✓	4	×
257	voxbo ([277])	×	✓	✓	✓	15	×
Neuroimage Visualization							
258	BrainBrowser ([278])	✓	✓	✓	×	36	×
259	Budapest Reference Connectome ([279])	✓	✓	✓	×	23	×
260	DV3D ([280])	×	✓	✓	✓	40	×
261	FreeSurfer ([281])	✓	✓	✓	✓	4514	✓
262	IClinfMRI ([282])	✓	✓	✓	✓	1	✓
263	Imaris for Neuroscientists ([283])	✓	×	×	✓	4	×
264	MindSeer ([284])	×	✓	✓	✓	18	×
265	MRICloud ([285])	✓	✓	✓	×	47	×
266	MMVT ([286])	✓	✓	✓	✓	6	✓
267	Neurolens ([287])	×	✓	✓	✓	9	×
268	NDVIZ ([288])	✓	✓	✓	×	0	×
269	Papaya ([289])	×	✓	✓	✓	159	✓
270	PySurfer ([290])	✓	✓	✓	✓	25	×
271	Scalable Brain Atlas ([291])	×	×	✓	×	94	×
272	WholeBrain ([292])	✓	✓	✓	✓	3	×
273	XNATView (XNAT) ([293])	✓	✓	✓	✓	20	✓
274	XTK ([294])	✓	✓	✓	×	50	×
Image Data Management and Annotation							
Format Management and Sharing							
275	BIOMIST ([295])	✓	✓	✓	✓	2	×
276	Brain-CODE ([296])	✓	✓	✓	×	14	×
277	BrainMap ([297])	×	✓	✓	✓	151	✓
278	Dinifti ([298])	✓	✓	✓	✓	16	✓

(*continued on next page*)

Table 2 (*continued*)

No.	Software Tool Names	Pub. Date (2012+)	Free	Linux based	Offline	Cited (Nov. 2021)	Installed
279	Icbm2tal ([299])	×	✓	✓	✓	1016	✓
280	MENGA ([300])	✓	✓	✓	✓	26	✓
281	MINC/Medical Image NetCDF ([88])	×	×	✓	×	26	×
282	MRIconvert files ([301])	×	✓	✓	✓	2	×
283	MRIcro ([302])	×	✓	✓	✓	236	✓
284	MRIcron ([303])	✓	✓	✓	✓	7	✓
285	NiBabel ([304])	✓	✓	✓	✓	30	✓
286	OpenNeuro ([305])	✓	✓	✓	×	25	×
287	PyNWB ([306])	✓	✓	✓	✓	65	✓
288	SHANOIR-NG ([307])	✓	✓	✓	✓	6	×
289	XmedCon ([308])	×	✓	✓	✓	62	×
290	XNAT ([293])	✓	✓	✓	✓	415	✓
DICOM File Management							
291	Aeskulap ([309])	×	✓	✓	✓	66	×
292	DCMCHECK ([310])	×	×	✓	✓	0	×
293	dcmodify ([311])	✓	✓	✓	✓	2	×
294	dcmstack ([312])	✓	✓	✓	✓	38	×
295	DCMTK ([313])	×	✓	✓	✓	52	✓
296	DIANA ([314])	✓	✓	✓	✓	49	✓
297	DICOM Confidential ([315])	×	✓	✓	✓	8	×
298	Dicom3tools ([316])	×	✓	✓	✓	17	×
299	DicomBrowser ([317])	✓	✓	✓	✓	17	✓
300	DicomCleaner ([318])	✓	✓	×	✓	46	×
301	DICOMpyler ([319])	×	✓	✓	✓	10	×
302	DICOMscope ([320])	✓	✓	×	✓	2	×
303	DICOMsort ([321])	×	✓	✓	✓	4	×
304	DICOMweb ([322])	✓	✓	✓	✓	74	✓
305	GDCM ([323])	✓	✓	✓	✓	3	✓
306	Ginkgo CADx ([324])	✓	✓	✓	✓	53	×
307	HeudiconV ([325])	✓	✓	✓	✓	21	✓
308	Imebra ([326])	✓	✓	✓	✓	0	×
309	Jivex DICOM viewer ([327])	×	✓	×	✓	102	×
310	MIPAV ([328])	✓	✓	✓	✓	478	✓
311	MRICroGL ([329])	✓	✓	✓	✓	2	×
312	odil ([330])	×	✓	✓	✓	95	✓
313	Orthanc ([331])	×	✓	✓	×	0	×
314	S-QFC ([332])	✓	×	✓	×	3	×
315	vtk-dicom ([333])	×	✓	✓	✓	9	×
316	VV: the 4D viewer ([334])	×	✓	✓	✓	32	✓
317	WEASIS ([324])	✓	✓	✓	✓	43	✓

this report shows details of the final set of tools presented within aXonica. Here, Table 4 has been presented separately as the tools mentioned therein are dependent on MATLAB, a commercial dependency.

Point 3: **Information:** To facilitate the user, the authors further provide details on (a) the download size, (b) date of the last update, and (c) current version for each of the 130 selected tools, as shown in see Table 3.

Point 4: **Shell scripting:** Developed separate shell files for every 130 tools filtered as per selection criterion. The authors preferred this approach, as creating a separate shell file allowed the installation of each tool to be independent of all others. Moreover, each shell file contained necessary commands for downloading and installing the tool along with their associated dependencies. As some dependencies were repeating, the authors developed a separate 'master-dependency' shell file to install these common dependencies. These included (i) JAVA JDK 8, (ii) python and python3, (iii) Scipy, (iv) Numpy, (v) python-pip and python-pip3, (vi) Matlab, and (vii) Qt. In addition, the authors developed six wrapper shell files corresponding to six components of the analysis. Each wrapper file linked each software available in aXonica to their corresponding analysis component. Fig. 1 shows the MRI-based analysis along with the list of tools presented in aXonica.

Point 5: **GUI:** Used "Zenity" to develop the front-end GUI to make our software user-friendly. The GUI helps the user move through several processing components easily. Collectively, aXonica employs ten user interface windows asking the user for specific input. They are:

1: **Security:** Asks the user to log in as superuser ('sudo') to obtain administrative privileges needed for the installation. At the same time, to protect systems available for public use, as in the case of a shared laboratory, the screen helps to terminate the installation process if the password is incorrect.

2: **Internet availability:** Verifies whether or not the system is connected to the internet, as the process downloads several tools and dependencies. The screen terminates the process if an active internet connection is not available.

3: **Common dependencies:** Installs seven common dependencies mentioned in the previous point.

4: **Install:** Prompts the user to begin the installation.

5: **Image pre-processing:** Facilitates the user to select and install tools related to (a) visualization, (b) enhancement, and (c) reconstruction.

6: **Image processing:** Helps in choosing and installing tools related to (a) registration, (b) segmentation, and (c) surfacing.

7: **Structural analysis:** Simplifies installing (a) Modeling, (b) Morphometric Analysis, (c) Quality Control, (d) Classification, (e) 3-D analysis, and (f) Mapping software.

8: **Diffusion data analysis:** Aids in the setup of tools for (a) Simulation, and (b) Tractography.

9: **Functional data analysis:** Installs (a) Neuroimage analysis, and (b) Neuroimage visualization software.

10: **Data Management and annotation:** Builds (a) DICOM file and (b) Format management tools.

Table 3
Software included in aXonica software package after application of selection criteria. The size of each software is mentioned in MB(s).

No.	Software	Download size	Version	Last Update
Image Pre-processing				
Image Visualization				
1	Anatomist (BrainVISA)[36]	3400	5.0.2	2021
2	BoneJ[39]	0.7	1.0.0	2021
3	Dipy[43]	11.6	1.4.1	2021
4	iELVis[48]	11	–	2021
5	ImageVIS3D[50]	13.2	3.1.0	2016
6	imlook4d[51]	18.8	5.8.2	2019
7	JIST[52]	43.9	3.2.0	2014
8	MeVisLab[55]	2000	3.4.2	2021
9	MIA[56]	4.2	2.4.7	2016
10	MITK[57]	163	18.04.02	2021
11	Nilearn[60]	4.7	0.8.0	2021
12	VistaDisp[335]	1331.44	–	2018
Image Enhancement				
13	AMIDE[74]	29	1.0.5	2017
14	CLAHE[78]	0.17	0.1.0	2021
15	CoSMoMVPA[79]	9.51	1.1.0	2021
16	C-PAC[80]	277	1.8.0	2021
17	Fast_Filters[336]	0.3	10.0.0	2017
18	FMRIPrep[84]	41	46.1.0	2021
19	GLMdenoise[85]	0.26	1.4.0	2021
20	HD-BET[76]	0.03	–	2021
21	MNI-N3[89]	1.3	1.12.0	2012
22	NormalizeFOV[91]	732.7	1.2.0	2016
23	PID[92]	3.9	1.9.0	2014
24	TORTOISE[94]	40	1.0.4	2016
3D Image Reconstruction				
25	Free-D[100]	8.5	1.15.0	2018
26	InVesalius[102]	91.8	3.1.9	2021
27	ITK-SNAP[103]	45.2	3.6.0	2019
28	PaCER[104]	9.78	1.0.7	2020
29	SIRF[106]	1.4	3.1.0	2021
Image Processing				
Image Segmentation				
30	ALVIN[109]	18.9	1	2020
31	Autoencoder Regularization[110]	0.8	–	2021
32	AxonDeepSeg 112	150	3.2.0	2021
33	BEaST[113]	0.5	1.15.0	2018
34	BrainSeg3D[114]	47.6	2.5.0	2021
35	CMP-BIA[116]	0.1	0.3	2016
36	E-Snake[118]	0.1	27.1	2012
37	FMRIPrep[84]	1	20.2.3	2021
38	HeteroscedasticfMRI[121]	2.1	–	2015
39	ITK[123]	88	5.2.1	2021
40	LiviaNET[124]	12.5	–	2019
41	MANTiS[127]	20.02	–	2021
42	medicalzoopytorch[128]	63	–	2021
43	pyClusterROI[132]	31	2	2015
44	RMNMS[133]	0.1	0.1.0	2015
45	seg 107	0.7	–	2018
46	SegAN[134]	0.7	–	2019
47	Segmentator[135]	4	1.6.0	2021
Image Registration				
48	AAL[136]	4.7	3.1	2020
49	AIR[137]	0.99	5.3.0	2010
50	ART[138]	6	1.07.1	2018
51	bUnwarpJ[140]	0.1	2.6.12	2021
52	elastix[143]	27.7	5.0.1	2021
53	IRTK[147]	0.6	1.0.0	2015
54	MIRTK[148]	313.71	2.0.0	2021
Image Surfacing				
55	ANTs[157]	21.3	2.3.5	2021
56	iso2mesh[160]	160	5.14.0	2021
57	Mango[161]	65	4.1.0	2016
58	NMT[269]	286.5	2.1.2	2021
59	SUMA[164]	90.9	4.4.7	2021
60	Surfing[165]	249.8	4.14.0	2020
Structural Data Analysis				
3D Image Analysis				
61	3D Slicer[167]	503	4.11.0	2021
62	BFAST3D[169]	0.2	–	2020
63	Brainstorm[171]	59	21.0.0	2021
64	calcFD[172]	0.55	31.0.0	2021
65	DCEMRI[173]	4	0.51.0	2021
66	DynamicBC[174]	14.74	2.2.0	2019
67	ImageJ[176]	85.5	153.0.0	2021
68	nipype[178]	11.11	1.6.1	2021
69	Nitime[179]	6.2	0.9.0	2021
70	PRoNTo 180	24.9	2.1.1	2021
71	TINA[186]	0.06	0.1.12	2020
72	VISTASOFT[188]	38.4	1.0.0	2021
Morphometric Analysis				
73	ASLtbx[192]	0.379	15.0.0	2015
74	CaPTk[194]	1400	1.8.1	2021
75	FracLac[196]	13.8	2.5.0	2021
76	GAT[197]	14.2	1.5.1	2014
77	Gwyddion[199]	12	2.55.0	2021
Quality Control				
78	ArtRepair[206]	0.1	5b3	2019
79	Mindcontrol[211]	6.34	1.3.3	2018
80	MRIQC[212]	3040	0.16.1	2021
Image Modelization				
81	ROAST[221]	180.52	3.0.0	2020
82	SIMRI[222]	6.4	2.0.0	2020
83	SimVascular[223]	799	6.15.0	2021
Image Classification				
84	LA-iMageS[227]	82.4	1.1.5	2017
Image Mapping				
85	Lead-DBS[230]	4069	1.6.3	2021
86	MRI Processor[231]	0.18	1.1.6	2021
Diffusion Data Analysis				
Image Simulation				
87	MITK-DI[233]	159	10.23.0	2021
88	SimTB[234]	2.9	18.0.0	2019
89	The Virtual Brain 235	1200	2.3.0	2021
Tractography				
90	brainGraph[237]	1.4	3.0.0	2021
91	Braintome DiffusionKit[238]	50.1	1.5.0	2020
92	DSI Studio[243]	75.4	21.08.0	2021
93	medInria[247]	82.7	3.2.0	2021
94	MRtrix3[248]	19.6	3.0.3	2021
95	PANDA[249]	10	1.3.1	2018
96	SlicerDMRI[251]	503	4.11.0	2021
Functional Data Analysis				
Neuroimage Analysis				
97	bgsmtr[255]	3.8	0.7.0	2019
98	BRAINSTools[256]	30	5.4.0	2021
99	BrainVISA[337]	3400	5.0.2	2021
100	BrainVoyager[257]	501	22.0.0	2021
101	CONN[259]	125	21a	2021
102	FSL[261]	0.09	6.0.4	2016
103	GC-LDA[262]	197.75	–	2021
104	NeuroElf[267]	27.1	1.1.0	2021
105	NMT[269]	286.5	2.1.2	2021
106	SliceMap[272]	42	1.0.0	2020
107	SDM[273]	279	6.21.0	2019
108	SPM[274]	111	12.0.0	2020
Neuroimage Visualization				
109	FreeSurfer[281]	3100	7.2.0	2021
110	IClinfMRI[282]	15.33	–	2021
111	Papaya[289]	121.1	–	2019
Image Data Management and Annotation				
Image Format Management				
112	BrainMap[297]	204.9	0.2.3	2017
113	Dinifti[298]	0.7	2.3.3	2013
114	Icbm2tal[299]	204.9	0.2.3	2021
115	MENGA[300]	3	3.1.0	2016
116	MRIcro[302]	8	1.39.0	2021
117	MRIcron[303]	17.31	1.0.0	2021
118	NiBabel[102]	3.3	3.2.1	2021
119	PyNWB[306]	1.14	2.0.0	2021
120	XNAT[293]	8	1.8.2	2018
DICOM File Management				
121	DCMTK[313]	11.4	3.6.5	2021
122	DIANA[314]	9.5	2.1.5	2018

(continued on next page)

Table 3 (*continued*)

No.	Software	Download size	Version	Last Update
123	DicomBrowser[317]	8.1	1.7.5	2020
124	DICOMweb[322]	0.021	0.40.0	2019
125	GDCM[323]	2.6	2.8.9	2021
126	HeudiconV[325]	0.341	0.9.0	2021
127	MIPAV[328]	100	10.0.0	2019
128	odil[330]	44.9	0.8.0	2021
129	VV: the 4D viewer[334]	15.2	1.4.0	2021
130	WEASIS[324]	38	3.7.1	2021

Table 4
The table enlists MATLAB-based tools included in aXonica.

No.	MATLAB plugins
1	AAL[136]
2	ALVIN[109]
3	ArtRepair[206]
4	ASLtbx[192]
5	BFAST3D[169]
6	Brainstorm[171]
7	calcFD[172]
8	CONN[259]
9	CoSMoMVPA[79]
10	DynamicBC[174]
11	GAT[197]
12	GLMdenoise[85]
13	IClinfMRI[282]
14	iELVis[48]
15	imlook4d[51]
16	iso2mesh[160]
17	Lead-DBS[230]
18	MENGA[300]
19	NeuroElf[267]
20	PANDA[249]
21	PaCER[104]
22	PRoNTo 180
23	ROAST[221]
24	seg 107
25	SimTB[234]
26	SPM[274]
27	Surfing[165]
28	The Virtual Brain 235
29	VistaDisp[335]
30	VISTASOFT[188]

5. Discussion

Together, NeuroDebian,[23] BIDS app,[24] Flywheel,[25] Qmenta,[26] Boutiques,[27] Brainlife,[28] Neurodesk,[29] and aXonica provide researchers and teachers with software that easily installs tools related to neuroscience. Most solutions cover neuroscience in general, some are dedicated (like aXonica to MRI-based neuroimaging), while others have a wider scope. For instance, NeuroDebian has only 4 tools for distributed computing, 13 for Electrophysiology, 26 for MRI, 3 for modeling, 1 for education, and 8 for Psychophysics, collectively containing 51 tools for neuroscience.[23]

Overall, all these solutions complement each other. BIDS App is focused, dedicated to the BIDS format, and slowly emerging as a standard for neuroimaging.[24] Boutiques is more flexible, facilitating its pipelines to be easily installed as separate containers, validated, published, and executed.[27,30,31] Flywheel[25] and Qmenta[26] are propriety, and perhaps will evolve further to cater better to serve revenue generating users, leaving four for users looking for 'free for use' tools, i.e., NeuroDebian,[23] Brainlife,[28] Neurodesk,[29] and aXonica.

Compared within these four and one additional BIDS App, aXonica is focused on MRI-based neuroimaging and unbiased towards any formatting standards. The selection process allowed the authors to survey 318 software, select and encapsulate 130 tools geared towards MRI-based neuroimaging.

aXonica presents more than 150 shell scripts encapsulated with graphical user interfaces for researchers and educationists to point-and-click their way to developing software workstations to study MRI-based neuroimaging, see Fig. 2. It contains 130 tools encompassing the entire analysis, see Fig. 1, Tables 2 and 3.

It is pertinent to mention that some tools presented in aXonica span the entire MRI-based analysis shown in Fig. 1. However, as research in MRI continues to evolve, it is appropriate to mention that some of these tools do not necessarily include all the steps shown in the analysis. Therefore, the authors have included the names of these tools at the bottom of Fig. 1, while Table 2 indicates that some of these tools span the entire MRI-based analysis.

aXonica is based on Ubuntu$\times$64 and is available for Windows and macOS, through virtualization (see Supplementary Section). To ensure the robustness and longevity of aXonica's installation was processed on Ubuntu 18.04 LTS and Ubuntu 20.04 LTS.

It is pertinent to mention that research groups having good funding, can circumvent many of the fundamental problems arising from maintaining and using neuroinformatics tools by hiring local, talented, IT support.

Lastly, admittedly so, there exists a lot of overlap and multiplication of labor within these four. Perhaps a joint working committee from these four solutions can collaborate to work together a unified scheme, helping both standardize existing frameworks while catering to a multitude of students, researchers and professionals.

6. Conclusion

This paper presents aXonica, a solution comprised of a GUI-based installation package consisting of 130 MRI-based neuroimaging tools. aXonica is freely available under the GPL v3.0 license. It comes with a detailed supplementary section encompassing tutorial data-sets, version history, and a step-by-step guide. Moreover, to ensure the longevity of aXonica, authors tested and verified its running on both Ubuntu 18.04 LTS and Ubuntu 20.04 LTS, and through virtualization on Windows.

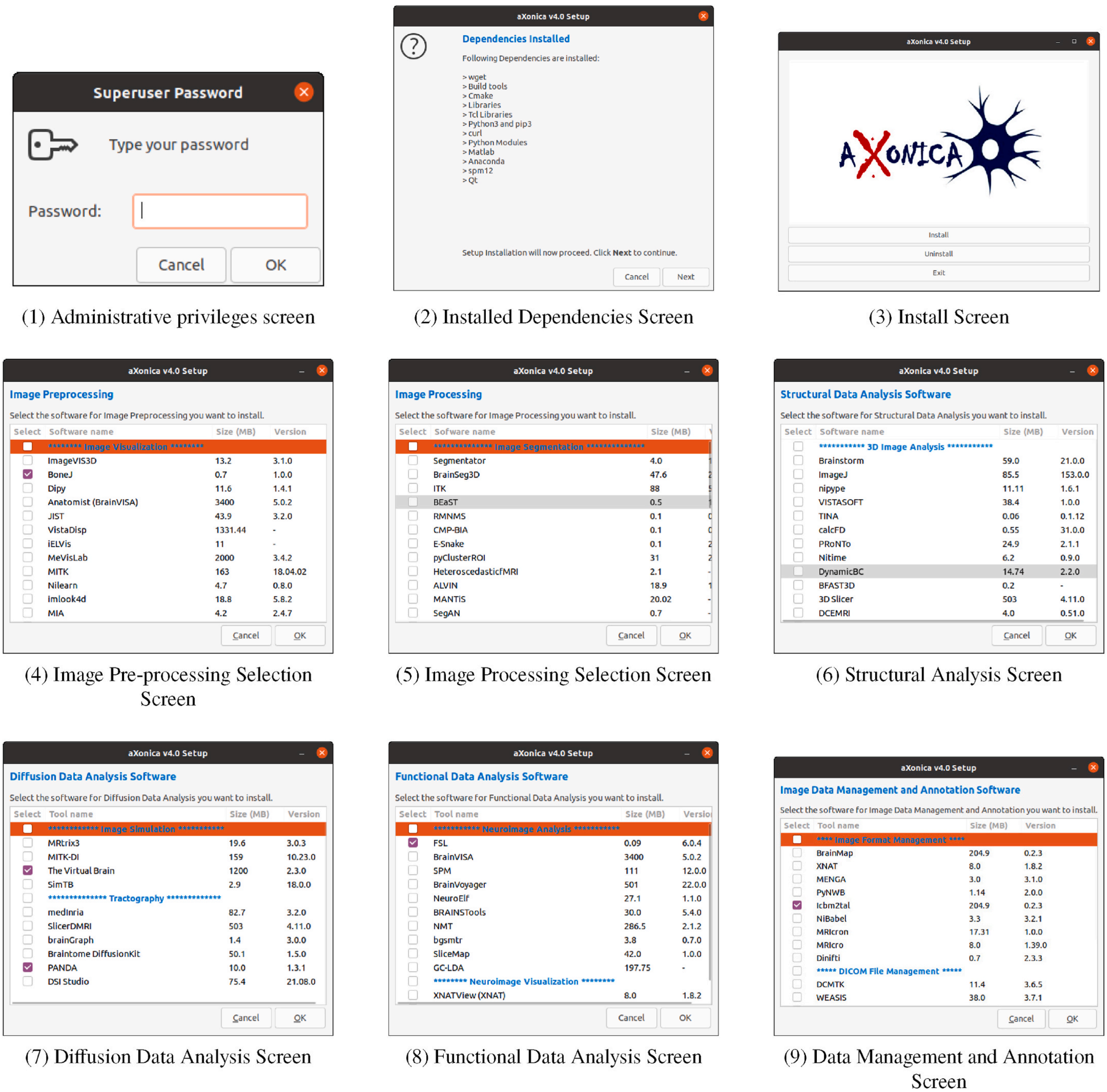
It is pertinent to mention that giving due respect to the community, the authors restricted themselves from suggesting any particular pipeline or a suggested list of tools. The readers/users are expected to install and work on those tools that are consistent and work together smoothly.

Moreover, based on recommendations from the community, the authors intend to update aXonica every three to four years (provided funding is available). It is highly likely that the number of tools available in aXonica may change over time. For instance, tools that require users to (i) register, or (ii) accept license, or (iii) may become paid software, or (iv) were published more than ten years ago and are not popular (have citations less than 100) with the research community will be discontinued. Whereas, tools (i) published until the next cycle of revision, or (ii) have been missed, or (iii) receive several recommendations by the community while adhering to the selection criterion addressed in Section 3 will be added in the next cycle.

In summary aXonica is a one-stop solution for developing software workstation for researchers and teachers. It (i) covers the entire MRI-analysis, (ii) is compatible with popular operating systems, (iii) up-to-date with recent tools, (iv) is user friendly, (v) supports sMRI, fMRI and dMRI, (vi) flexible, (vii) transparent, and (ix) allows for reproducing the analysis for MRI based neuroimaging.

Additional information

- **Name:** aXonica
- **Current Version:** v4.0
- **URL:** https://github.com/mominaj/aXonica-bin
- **Operating System:** Ubuntu 18.04 LTS, Ubuntu 20.04 LTS through direct use, Windows and macOS through virtualization.
- **License:** GNU General Public License (GPL v3.0)



(1) Administrative privileges screen (2) Installed Dependencies Screen (3) Install Screen

(4) Image Pre-processing Selection Screen (5) Image Processing Selection Screen (6) Structural Analysis Screen

(7) Diffusion Data Analysis Screen (8) Functional Data Analysis Screen (9) Data Management and Annotation Screen

Fig. 2. The figure shows some dialog boxes that appear during the installation process (for brevity, only a few screens are shown). The installation begins by (1) getting the superuser password, (2) checking the internet connection. If the system has a stable internet connection, installation of aXonica begins by installing required dependencies, followed by a (3) Install screen, followed by (4) Image preprocessing Selection screen (5) Image Processing Selection screen (6) Structural Analysis Screen (7) Diffusion Data Analysis Screen (8) Functional Data Analysis Screen and (9) Data Management and Annotation Screen. As shown above, by (a) demarcating tools with respect to their corresponding analysis component, (b) mentioning their download size, and (c) version, the authors hope that users obtain sufficient help in choosing the set of tools needed for their MRI-based analysis.

- **Internet Connection:** Required
- **Contact:** mominaj05@gmail.com; bilalwajidabbas@hotmail.com
- **Note:** Administrative privileges are required to install the software.

Conflict of interest

None declared.

CRediT authorship contribution statement

Bilal Wajid: Conceptualization, Formal analysis, Funding acquisition, Methodology, Project administration, Software, Supervision, Writing – original draft, Writing – review & editing. **Momina Jamil:** Data curation, Formal analysis, Methodology, Resources, Software, Writing – original draft. **Fahim Gohar Awan:** Project administration, Supervision, Writing – review & editing. **Faria Anwar:** Conceptualization, Investigation, Writing – review & editing. **Ali Anwar:** Project administration, Supervision, Writing – review & editing.

Declaration of competing interest

The authors declare no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.biotno.2024.08.001.

References

1. Anaqi Abang Isa Abang Mohd Arif, Kipli Kuryati, Mahmood Muhammad Hamdi, et al. A review of mri acute ischemic stroke lesion segmentation. *International Journal of Integrated Engineering*. 2020;12(6):117–127.
2. Azeemuddin Muhammad, Alvi Amna, Sayani Raza, et al. Neuroimaging findings in tuberculosis: a single-center experience in 559 cases. *J Neuroimaging*. 2019;29(5): 657–668.
3. Hanif Sumaira, Muhammad Pir, Niu Zheng, et al. Nanotechnology-based strategies for early diagnosis of central nervous system (cns) disorders. *Advanced NanoBiomed Research*. 2021, 2100008.
4. Altaheri Hamdi, Muhammad Ghulam, Alsulaiman Mansour, et al. Deep learning techniques for classification of electroencephalogram (eeg) motor imagery (mi) signals: a review. *Neural Comput Appl*. 2021:1–42.
5. Abdallah Yousif Mohamed Y, Abuhadi Nouf H. The role of magnetic resonance imaging (mri) in autonomic nervous system monitoring. In: *Autonomic Nervous System Monitoring-Heart Rate Variability*. 2019. IntechOpen.
6. Abdelaziz Ismael Sarah Ali, Mohammed Ammar, Hefny Hesham. An enhanced deep learning approach for brain cancer mri images classification using residual networks. *Artif Intell Med*. 2020;102, 101779.
7. Choque-Velasquez Joham, Colasanti Roberto, Baluszek Szymon, et al. Systematic review of pineal cysts surgery in pediatric patients. *Child's Nerv Syst*. 2020:1–12.
8. Wajid Bilal, Serpedin Erchin. Do it yourself guide to genome assembly. *Briefings in functional genomics*. 2016;15(1):1–9.
9. Wajid Bilal, Serpedin Erchin, Nounou Mohamed, Nounou Hazem. Maragap: a modular approach to reference assisted genome assembly pipeline. *Int J Comput Biol Drug Des*. 2015;8(3):226–250.
10. Khalid Muhammad, Iman Kanzal, Ghafoor Amna, et al. Perceptron: an open-source gpu-accelerated proteoform identification pipeline for top-down proteomics. *Nucleic Acids Res*. 2021;49(W1):W510–W515.
11. Wajid Bilal, Sohail Muhammad U, Ali R Ekti, Serpedin Erchin. The a, c, g, and t of genome assembly. *BioMed Res Int*. 2016:2016.
12. Naseer Gondal Mahnoor, Sultan Muhammad U, Arif Ammar, et al. Tison: a next-generation multi-scale modeling theatre for in silico systems oncology. *bioRxiv*. 2021.
13. Wajid Bilal, Anwar Faria, Wajid Imran, et al. *Music of Metagenomics—A Review of its Applications, Analysis Pipeline, and Associated Tools*. Functional & integrative genomics; 2021:1–24.
14. Wajid Bilal, Iqbal Hasan, Jamil Momina, Rafique Hafsa, Anwar Faria. Metumpx—a metabolomics support package for untargeted mass spectrometry. *Bioinformatics*. 2020;36(5):1647–1648.
15. Aron Shaun, Abel Chauke Paballo, Ras Verena, Panji Sumir, Johnston Katherine, Mulder Nicola. The development of a sustainable bioinformatics training environment within the h3africa bioinformatics network (h3abionet). In: *Frontiers in Education*. 6. 2021, 725702. Frontiers Media SA.
16. Kibet Caleb K, Entfellner Jean-Baka Domelevo, Jjingo Daudi, et al. Designing and delivering bioinformatics project-based learning in east africa. *BMC Bioinf*. 2024; 25(1):150.
17. Adenaike Omolara, Olabanjo Olufemi Emmanuel, Adedeji Ayansewa Adeleke. Integrating computational skills in undergraduate microbiology curricula in developing countries. *Biology Methods and Protocols*. 2023;8(1), bpad008.
18. Rivière Emmanuel, Heupink Tim H, Ismail Nabila, et al. Capacity building for whole genome sequencing of mycobacterium tuberculosis and bioinformatics in high tb burden countries. *Briefings Bioinf*. 2021;22(4), bbaa246.
19. Drew Jennifer, Morgan William, Galindo Sebastian, et al. Revisiting barriers to implementation of bioinformatics into life sciences education. *Frontiers in Education*. 2023;8, 1317191. Frontiers Media SA.
20. Wilson Nicholas, Keni Keni, Tan Pauline Henriette Pattyranie. The role of perceived usefulness and perceived ease-of-use toward satisfaction and trust which influence computer consumers' loyalty in China. *Gadjah Mada Int J Bus*. 2021;23 (3):262–294.
21. Pavelin Katrina, Cham Jennifer A, de Matos Paula, Brooksbank Cath, Cameron Graham, Steinbeck Christoph. Bioinformatics meets user-centred design: a perspective. *PLoS Comput Biol*. 2012;8(7), e1002554.
22. Shachak Aviv, Shuval Kerem, Fine Sara. Barriers and enablers to the acceptance of bioinformatics tools: a qualitative study. *J Med Libr Assoc: JMLA*. 2007;95(4):454.
23. Halchenko Yaroslav O, Hanke Michael. Open is not enough. let's take the next step: an integrated, community-driven computing platform for neuroscience. *Front Neuroinf*. 2012;6:22.
24. Gorgolewski Krzysztof J, Alfaro-Almagro Fidel, Auer Tibor, et al. Bids apps: improving ease of use, accessibility, and reproducibility of neuroimaging data analysis methods. *PLoS Comput Biol*. 2017;13(3), e1005209.
25. Tapera Tinashe M, Cieslak Matthew, Bertolero Max, et al. Flywheeltools: data curation and manipulation on the flywheel platform. *Front Neuroinf*. 2021;15, 678403.
26. Scarpazza Cristina, Ha Minji, Baecker Lea, et al. Translating research findings into clinical practice: a systematic and critical review of neuroimaging-based clinical tools for brain disorders. *Transl Psychiatry*. 2020;10(1):107.
27. Glatard Tristan, Kiar Gregory, Aumentado-Armstrong Tristan, et al. Boutiques: a flexible framework to integrate command-line applications in computing platforms. *GigaScience*. 2018;7(5), giy016.
28. Hayashi Soichi, Caron Bradley A, Heinsfeld Anibal Sólon, et al. brainlife. io: a decentralized and open-source cloud platform to support neuroscience research. *Nat Methods*. 2024:1–5.
29. Renton Angela I, Dao Thuy T, Johnstone Tom, et al. Neurodesk: an accessible, flexible and portable data analysis environment for reproducible neuroimaging. *Nat Methods*. 2024:1–5.
30. Valevicius Darius, Beck Natacha, Kasper Lars, et al. Web-based processing of physiological noise in fmri: addition of the physio toolbox to cbrain. *Front Neuroinf*. 2023;17, 1251023.
31. Mazaheri Mandana, Kiar Gregory, Glatard Tristan. A recommender system for scientific datasets and analysis pipelines. In: *2021 IEEE Workshop on Workflows in Support of Large-Scale Science (WORKS)*. IEEE; 2021:1–8.
32. Pemberton Hugh G, Lara AM Zaki, Goodkin Olivia, et al. Technical and clinical validation of commercial automated volumetric mri tools for dementia diagnosis—a systematic review. *Neuroradiology*. 2021;63(11):1773–1789.
33. Ehsan Mahmoudi Seyyed, Akhondi-Asl Alireza, Rahmani Roohollah, et al. Web-based interactive 2d/3d medical image processing and visualization software. *Comput Methods Progr Biomed*. 2010;98(2):172–182.
34. Yeatman Jason D, Richie-Halford Adam, Smith Josh K, Keshavan Anisha, Rokem Ariel. Afq-browser: supporting reproducible human neuroscience research through browser-based visualization tools. *bioRxiv*. 2018;182402.
35. Bordier Cecile, Dojat Michel, Lafaye de Micheaux Pierre. Analyzefmri: an r package to perform statistical analysis on fmri datasets. In: *useR! 2009-The R User Conference*. 25. 2008.
36. Riviere D, Régis J, Cointepas Yann, et al. A freely available anatomist/brainvisa package for structural morphometry of the cortical sulci. *Neuroimage*. 2003;19(2): e1825–e1826.
37. Papademetris Xenophon, Jackowski Marcel P, Rajeevan Nallakkandi, et al. Bioimage suite: an integrated medical image analysis suite: an update. *The insight journal*. 2006:209, 2006.
38. Houck Keith A, Dix David J, Judson Richard S, Kavlock Robert J, Yang Jian, Berg Ellen L. Profiling bioactivity of the toxcast chemical library using biomap primary human cell systems. *J Biomol Screen*. 2009;14(9):1054–1066.
39. Doube Michael, Kłosowski Michał M, Arganda-Carreras Ignacio, et al. Bonej: free and extensible bone image analysis in imagej. *Bone*. 2010;47(6):1076–1079.
40. Hooks Bryan M, Papale Andrew E, Paletzki Ronald F, et al. Topographic precision in sensory and motor corticostriatal projections varies across cell type and cortical area. *Nat Commun*. 2018;9(1):1–16.
41. Xu Kaibin, Liu Yong, Zhan Yafeng, Ren Jiaji, Jiang Tianzi. Brant: a versatile and extendable resting-state fmri toolkit. *Front Neuroinf*. 2018;12.
42. de Ridder Michael, Klein Karsten, Yang Jean, et al. An uncertainty visual analytics framework for fmri functional connectivity. *Neuroinformatics*. 2019;17(2): 211–223.
43. Garyfallidis Eleftherios, Brett Matthew, Amirbekian Bagrat, et al. Dipy, a library for the analysis of diffusion mri data. *Front Neuroinf*. 2014;8(8).
44. Selmi Sonia-Yuki, Promayon Emmanuel, Sarrazin Johan, Troccaz Jocelyne. 3d interactive ultrasound image deformation for realistic prostate biopsy simulation. In: *International Symposium on Biomedical Simulation*. 2014:122–130. Springer.
45. Yam Chun-Shan, Kruskal Jonathan, Pedrosa Ivan, Kressel Herbert. Part ii: preparing and assessing first-year radiology resident on-call readiness: technical implementation. *Acad Radiol*. 2006;13(6):770–773.
46. Ledoux Louis-Philippe, Morency Felix C, Cousineau Martin, Houde Jean-Christophe, Whittingstall Kevin, Descoteaux Maxime. Fiberweb: diffusion visualization and processing in the browser. *Front Neuroinf*. 2017;11(54).
47. Shin Taehoon, Nayak Krishna S, Santos Juan M, Nishimura Dwight G, Hu Bob S, McConnell Michael V. Three-dimensional first-pass myocardial perfusion mri using a stack-of-spirals acquisition. *Magn Reson Med*. 2013;69(3):839–844.
48. Groppe David M, Bickel Stephan, Dykstra Andrew R, et al. ielvis: an open source matlab toolbox for localizing and visualizing human intracranial electrode data. *J Neurosci Methods*. 2017;281:40–48.
49. Enquobahrie Andinet, Cheng Patrick, Gary Kevin, et al. The image-guided surgery toolkit igstk: an open source c++ software toolkit. *J Digit Imag*. 2007;20(1):21–33.
50. CBIC ImageVis3D. *A Real-Time Volume Rendering Tool for Large Data. Scientific Computing And Imaging Institute (SCI)*. 2012.
51. Jan Axelsson. Imlook4d: introducing an extendable research 4d analysis software. In: *XII Turku PET Symposium*. 2014:63.
52. Blake C Lucas, Bogovic John A, Carass Aaron, et al. The java image science toolkit (jist) for rapid prototyping and publishing of neuroimaging software. *Neuroinformatics*. 2010;8(1):5–17.

53. Cocosco Chris A, Evans Alan C. Java internet viewer: a www tool for remote 3d medical image data visualization and comparison. In: *International Conference on Medical Image Computing and Computer-Assisted Intervention*. Springer; 2001: 1415–1416.
54. Undt Gerhard, Wild Klaus, Reuther Gerd, Ewers Rolf. Mri-based stereolithographic models of the temporomandibular joint: technical innovation. *J Cranio-Maxillofacial Surg*. 2000;28(5):258–263.
55. Newe Axel, Ganslandt Thomas. Simplified generation of biomedical 3d surface model data for embedding into 3d portable document format (pdf) files for publication and education. *PLoS One*. 2013;8(11), e79004.
56. Wollny Gert, Kellman Peter, Ledesma-Carbayo María-Jesus, Skinner Matthew M, Hublin Jean-Jaques, Hierl Thomas. Mia-a free and open source software for gray scale medical image analysis. *Source Code Biol Med*. 2013;8(1):1–20.
57. Debus Charlotte, Floca Ralf, Ingrisch Michael, et al. Mitk-modelfit: a generic open-source framework for model fits and their exploration in medical imaging–design, implementation and application on the example of dce-mri. *BMC Bioinf*. 2019;20 (1):31.
58. Bozoki Andrea C, Korolev Igor O, Davis Nathan C, Hoisington Lori A, Berger Kevin L. Disruption of limbic white matter pathways in mild cognitive impairment and alzheimer's disease: a dti/fdg-pet study. *Hum Brain Mapp*. 2012;33(8):1792–1802.
59. Shin Jonghan, Lee Sang-Yoon, Kim So-Hee, Kim Young-Bo, Cho Seong-Jin. Multitracer pet imaging of amyloid plaques and neurofibrillary tangles in alzheimer's disease. *Neuroimage*. 2008;43(2):236–244.
60. Alexandre Abraham, Pedregosa Fabian, Eickenberg Michael, et al. Machine learning for neuroimaging with scikit-learn. *Front Neuroinf*. 2014;8(14).
61. Feng Chao, Kovrigin Evgenii L, Post Carol Beth. Nmrlineguru: standalone and user-friendly guis for fast 1d nmr lineshape simulation and analysis of multi-state equilibrium binding models. *Sci Rep*. 2019;9(1):1–14.
62. Rosset Antoine, Spadola Luca, Ratib Osman. Osirix: an open-source software for navigating in multidimensional dicom images. *J Digit Imag*. 2004;17(3):205–216.
63. Iwai Takafumi, Kitada Sohei, Higaki Mariko, Deguchi Mizuki, Kaijima Kazuya, Wakita Akira. Paravision: the entertaining visualizer in public space. In: *International Conference on Advances in Computer Entertainment Technology 2006*. 2006. page 1178928.
64. Borghammer Per, Chakravarty Mallar, Jonsdottir Kristjana Yr, et al. Cortical hypometabolism and hypoperfusion in Parkinson's disease is extensive: probably even at early disease stages. *Brain Struct Funct*. 2010;214(4):303–317.
65. Larrabide I, Feijóo RA, Novotny AA, Taroco E, Masmoudi M. An image segmentation method based on a discrete version of the topological derivative. *World Congress Structural and Multidisciplinary Optimization*. 2005;6:1–11. Citeseer.
66. Achanta Sirisha, Gorky Jonathan, Leung Clara, et al. A comprehensive integrated anatomical and molecular atlas of rat intrinsic cardiac nervous system. *iScience*. 2020;23(6), 101140.
67. Quanz Henrik, Schreiner Peter R. Tunnex: an easy-to-use wentzel-kramers-brillouin (wkb) implementation to compute tunneling half-lives. *J Comput Chem*. 2019;40(2):543–547.
68. Rueden Curtis, Eliceiri Kevin W, White John G. Visbio: a computational tool for visualization of multidimensional biological image data. *Traffic*. 2004;5(6): 411–417.
69. Nord Catharina. *The visible patient. Hybridity and Inpatient Ward Design in a Namibian Context*. 2003. PhD thesis, Infrastruktur.
70. Popa Teo, Ibanez Luis, Levy Elliot, White Amy, Bruno Jill, Cleary Kevin. Tumor volume measurement and volume measurement comparison plug-ins for volview using itk. In: *Medical Imaging 2006: Visualization, Image-Guided Procedures, and Display*. 6141. 2006:61411B. International Society for Optics and Photonics.
71. Colburn A, Gleeson T, Laird J. *Vaytek: voxblast 3d measurement and visualization. Iowa City: Image Analysis Facility*. University of Iowa; 1998.
72. Ali Mohammad Akbar, Mirza Aminul Huq, Fereday RJ, et al. Synthetic, epr spectroscopic, magnetic and x-ray crystallographic structural studies on copper (ii) complexes of the tridentate n2s donor ligand formed from 6-methyl-2-formylpyr-idine and s-methyldithiocarbazate (hmpsme). *Inorg Chim Acta*. 2005;358(13): 3937–3948.
73. Bao Feng, Deng Yue, Dai Qionghai. Acid: association correction for imbalanced data in gwas. *IEEE ACM Trans Comput Biol Bioinf*. 2016;15(1):316–322.
74. Markus Loening Andreas, Gambhir Sanjiv Sam. Amide: a free software tool for multimodality medical image analysis. *Mol Imag*. 2003;2(3), 15353500200303133.
75. Hoffmann Devy, Tabelow Karsten. *Structural Adaptive Smoothing for Single-Subject Analysis in Spm: The Aws4spm-Toolbox*. 2008.
76. Smith Stephen M. Fast robust automated brain extraction. *Hum Brain Mapp*. 2002; 17(3):143–155.
77. Eklund Anders, Dufort Paul, Villani Mattias, LaConte Stephen. Broccoli: software for fast fmri analysis on many-core cpus and gpus. *Front Neuroinf*. 2014;8(24).
78. Ali M Reza. Realization of the contrast limited adaptive histogram equalization (clahe) for real-time image enhancement. *Journal of VLSI signal processing systems for signal, image and video technology*. 2004;38(1):35–44.
79. Oosterhof Nikolaas N, Connolly Andrew C, Haxby James V. Cosmomvpa: multi-modal multivariate pattern analysis of neuroimaging data in matlab/gnu octave. *Front Neuroinf*. 2016;10(27).
80. Craddock Cameron, Sikka Sharad, Cheung Brian, et al. Towards automated analysis of connectomes: the configurable pipeline for the analysis of connectomes (c-pac). *Front Neuroinf*. 2013;42.
81. Pizarro Ricardo, Assemlal Haz-Edine, De Nigris Dante, et al. Using deep learning algorithms to automatically identify the brain mri contrast: implications for managing large databases. *Neuroinformatics*. 2019;17(1):115–130.
82. Jiao Hong-wei, Hu Chun-sheng, Wang Xing-shu, Shi-qiao QIN. Fast filter algorithm for 3d imaging laser radar data. *Infrared Laser Eng*. 2007;36(5):762.
83. Fissell Kate, Tseytlin Eugene, Cunningha Daniel, et al. *Fiswidgets. Neuroinformatics*. 2003;1(1):111–125.
84. Esteban Oscar, Markiewicz Christopher J, Blair Ross W, et al. fmriprep: a robust preprocessing pipeline for functional mri. *Nat Methods*. 2019;16(1):111.
85. Charest Ian, Kriegeskorte Nikolaus, Kay Kendrick N. Glmdenoise improves multivariate pattern analysis of fmri data. *Neuroimage*. 2018;183:606–616.
86. Hung Andy H, Liang Taiyang, Sukerkar Preeti A, Meade Thomas J. High dynamic range processing for magnetic resonance imaging. *PLoS One*. 2013;8(11), e77883.
87. Lajos R Kozák, van Graan Louis André, Chaudhary Umair J, Szabó Ádám György, Lemieux Louis. Icn_atlas: automated description and quantification of functional mri activation patterns in the framework of intrinsic connectivity networks. *Neuroimage*. 2017;163:319–341.
88. Vincent Robert D, Janke Andrew, Sled John G, Baghdadi Leila, Neelin Peter, Evans Alan C. Minc 2.0: a modality independent format for multidimensional medical images. In: *10th Annual Meeting of the Organization for Human Brain Mapping*. Volume 2003. 2004:2003.
89. Sled John G, Zijdenbos Alex P, Evans Alan C. A nonparametric method for automatic correction of intensity nonuniformity in mri data. *IEEE Trans Med Imag*. 1998;17(1):87–97.
90. Bellec Pierre, Lavoie-Courchesne Sébastien, Dickinson Phil, Lerch Jason, Zijdenbos Alex, Evans Alan C. The pipeline system for octave and matlab (psom): a lightweight scripting framework and execution engine for scientific workflows. *Front Neuroinf*. 2012;6(7).
91. Ou Yangming, Zöllei Lilla, Da Xiao, et al. Field of view normalization in multi-site brain mri. *Neuroinformatics*. 2018;16(3):431–444.
92. Griffa A, Garin N, Sage D. Comparison of deconvolution software: a user point of view—part 2. *GIT Imaging & Microscopy*. 2010;12:41–43. EPFL-ARTICLE-163628).
93. Shidahara Miho, Tsoumpas Charalampos, Hammers Alexander, et al. Functional and structural synergy for resolution recovery and partial volume correction in brain pet. *Neuroimage*. 2009;44(2):340–348.
94. Pierpaoli C, Walker L, Irfanoglu MO, et al. *Tortoise: an integrated software package for processing of diffusion mri data*. In: *18th Scientific Meeting of the International Society for Magnetic Resonance in Medicine*. 1597. 2010.
95. Krissian Karl, Santana-Jorge Francisco, Santana-Cedrés Daniel, et al. Amilab software: medical image analysis, processing and visualization. In: *MMVR*. 2012: 233–237.
96. Filée Patrice, Delmarcelle Michaël, Thamm Iris, Joris Bernard. Use of an alfexpress™ dna sequencer to analyze protein-nucleic acid interactions by band shift assay. *Biotechniques*. 2001;30(5):1044–1051.
97. Chipman Hugh A, George Edward I, McCulloch Robert E. Bart: bayesian additive regression trees. *Ann Appl Stat*. 2010;4(1):266–298.
98. Wu Qiufeng, Chen Yiping, Meng Jun. Dcgan-based data augmentation for tomato leaf disease identification. *IEEE Access*. 2020;8:98716–98728.
99. Kainz Bernhard, Steinberger Markus, Wein Wolfgang, et al. Fast volume reconstruction from motion corrupted stacks of 2d slices. *IEEE Trans Med Imag*. 2015;34(9):1901–1913.
100. Andrey Philippe, Maurin Yves. Free-d: an integrated environment for three-dimensional reconstruction from serial sections. *J Neurosci Methods*. 2005;145(1-2):233–244.
101. Schacht Hansen Michael, Sørensen Thomas Sangild. Gadgetron: an open source framework for medical image reconstruction. *Magn Reson Med*. 2013;69(6): 1768–1776.
102. De Moraes Thiago F, Amorim Paulo HJ, Azevedo Fábio S, Invesalius JV da Silva. *An open-source imaging application. Computational Vision and Medical Image Processing: Vipimage*. 2011:405–408.
103. Yushkevich Paul A, Piven Joseph, Cody Hazlett Heather, et al. User-guided 3d active contour segmentation of anatomical structures: significantly improved efficiency and reliability. *Neuroimage*. 2006;31(3):1116–1128.
104. Husch Andreas, Petersen Mikkel V, Gemmar Peter, Goncalves Jorge, Hertel Frank. Pacer-a fully automated method for electrode trajectory and contact reconstruction in deep brain stimulation. *Neuroimage: Clinic*. 2018;17:80–89.
105. Xu Zheng, Wang Sheng, Li Yeqing, Zhu Feiyun, Huang Junzhou. Prim: an efficient preconditioning iterative reweighted least squares method for parallel brain mri reconstruction. *Neuroinformatics*. 2018;16(3-4):425–430.
106. Ovtchinnikov Evgueni, Brown Richard, Kolbitsch Christoph, et al. Sirf: synergistic image reconstruction framework. *Comput Phys Commun*. 2020;249, 107087.
107. Aganj Iman, Harisinghani Mukesh G, Weissleder Ralph, Fischl Bruce. Unsupervised medical image segmentation based on the local center of mass. *Sci Rep*. 2018;8(1): 1–8.
108. Correa Nicolle, Adalı Tülay, Calhoun Vince D. Performance of blind source separation algorithms for fmri analysis using a group ica method. *Magn Reson Imag*. 2007;25(5):684–694.
109. Kempton Matthew J, Underwood Tracy SA, Brunton Simon, et al. A comprehensive testing protocol for mri neuroanatomical segmentation techniques: evaluation of a novel lateral ventricle segmentation method. *Neuroimage*. 2011;58(4):1051–1059.
110. Myronenko Andriy. 3d mri brain tumor segmentation using autoencoder regularization. In: *International MICCAI Brainlesion Workshop*. Springer; 2018: 311–320.
111. Kraus Birgit, Wolff Horst. High content analysis with axiovision assaybuilder™: applications in pharmaceutical biology. *Biotechniques*. 2008;44(6):820–823.
112. Zaimi Aldo, Wabartha Maxime, Herman Victor, Antonsanti Pierre-Louis, Perone Christian S, Cohen-Adad Julien. Axondeepseg: automatic axon and myelin segmentation from microscopy data using convolutional neural networks. *Sci Rep*. 2018;8(1):1–11.
113. Simon F Eskildsen, Coupé Pierrick, Fonov Vladimir, et al. Beast: brain extraction based on nonlocal segmentation technique. *Neuroimage*. 2012;59(3):2362–2373.

114. Bouzidi Dalenda, Ghozzi Fahmi, Taouil Khaled, Ahmed Fakhfakh. Brainseg3d to detect multiple sclerosis lesions using magnetic resonance imaging. In: *2020 IEEE International Conference on Design & Test of Integrated Micro & Nano-Systems (DTS)*. 2020:1–6. IEEE.
115. Morrison Melanie A, Payabvash Seyedmehdi, Chen Yicheng, et al. A user-guided tool for semi-automated cerebral microbleed detection and volume segmentation: evaluating vascular injury and data labelling for machine learning. *Neuroimage: Clinic*. 2018;20:498–505.
116. Arganda-Carreras Ignacio, Sorzano Carlos OS, Marabini Roberto, et al. Consistent and elastic registration of histological sections using vector-spline regularization. In: *International Workshop on Computer Vision Approaches to Medical Image Analysis*. 2006:85–95. Springer.
117. Aganj Iman, Fischl Bruce. Expected label value computation for atlas-based image segmentation. In: *2019 IEEE 16th International Symposium on Biomedical Imaging (ISBI 2019)*. 2019:334–338. IEEE.
118. Delgado-Gonzalo Ricard, Thevenaz Philippe, Seelamantula Chandra Sekhar, et al. Snakes with an ellipse-reproducing property. *IEEE Trans Image Process*. 2012;21(3): 1258–1271.
119. Vicente Sara, Kolmogorov Vladimir, Rother Carsten. Graph cut based image segmentation with connectivity priors. In: *2008 IEEE Conference on Computer Vision and Pattern Recognition*. 2008:1–8. IEEE.
120. Zhou Jiarui, Weber Ralf JM, Allwood J William, et al. Hammer: automated operation of mass frontier to construct in silico mass spectral fragmentation libraries. *Bioinformatics*. 2013;30(4):581–583.
121. Eklund Anders, Lindquist Martin A, Villani Mattias. A bayesian heteroscedastic glm with application to fmri data with motion spikes. *Neuroimage*. 2017;155:354–369.
122. Siddiqua Ayesha, Ali Shah Munam, Ali Khattak Hasan, Ud Din Ikram, Guizani Mohsen. Icafe: intelligent congestion avoidance and fast emergency services. *Future Generat Comput Syst*. 2019;99:365–375.
123. Yoo Terry S, Ackerman Michael J, Lorensen William E, et al. *Engineering and algorithm design for an image processing api: a technical report on itk-the insight toolkit. Studies in Health Technology and Informatics*. 2002:586–592.
124. Dolz Jose, Desrosiers Christian, Ayed Ismail Ben. 3d fully convolutional networks for subcortical segmentation in mri: a large-scale study. *Neuroimage*. 2018;170: 456–470.
125. Scherrer Benoît, Dojat Michel, Forbes Florence, Garbay Catherine. Locus: local cooperative unified segmentation of mri brain scans. In: *International Conference on Medical Image Computing and Computer-Assisted Intervention*. 2007:219–227. Springer.
126. Febrian Rachmadi Muhammad, Hernández Maria Valdés, Li Hongwei, et al. Limited one-time sampling irregularity age map (lots-iam): automatic unsupervised detection of brain white matter abnormalities in structural magnetic resonance images. *bioRxiv*. 2018:334292.
127. Beare Richard J, Chen Jian, Kelly Claire E, et al. Neonatal brain tissue classification with morphological adaptation and unified segmentation. *Front Neuroinf*. 2016;10 (12).
128. Nikolaos Adaloglou. *Deep learning in medical image analysis: a comparative analysis of multi-modal brain-mri segmentation with 3d deep neural networks. Master's Thesis*. University of Patras; 2019. https://github.com/black0017/MedicalZooPytorch.
129. Feng Yutong, Feng Yifan, You Haoxuan, Zhao Xibin, Gao Yue. Meshnet: mesh neural network for 3d shape representation. In: *Proceedings of the AAAI Conference on Artificial Intelligence*. 2019:8279–8286.
130. Valcarcel Alessandra M, Linn Kristin A, Vandekar Simon N, et al. Mimosa: an automated method for intermodal segmentation analysis of multiple sclerosis brain lesions. *J Neuroimaging*. 2018;28(4):389–398.
131. Sharp Gregory C, Li Rui, Wolfgang John, et al. Plastimatch-an open source software suite for radiotherapy image processing. In: *Proceedings of the XVI'th International Conference on the Use of Computers in Radiotherapy (ICCR)*. 2010. Amsterdam, Netherlands.
132. Cameron Craddock R, Andrew James G, Holtzheimer Paul E, et al. A whole brain fmri atlas generated via spatially constrained spectral clustering. *Hum Brain Mapp*. 2012;33(8):1914–1928.
133. Guizard Nicolas, Coupé Pierrick, Fonov Vladimir S, Manjón Jose V, Arnold Douglas L, Collins D Louis. Rotation-invariant multi-contrast non-local means for ms lesion segmentation. *Neuroimage: Clinic*. 2015;8:376–389.
134. Yuan Xue, Xu Tao, Zhang Han, Long L Rodney, Huang Xiaolei. Segan: adversarial network with multi-scale l 1 loss for medical image segmentation. *Neuroinformatics*. 2018;16(3-4):383–392.
135. Faruk Gulban Omer, Schneider Marian, Marquardt Ingo, Haast Roy AM, De Martino Federico. A scalable method to improve gray matter segmentation at ultra high field mri. *PLoS One*. 2018;13(6), e0198335.
136. Rolls Edmund T, Huang Chu-Chung, Lin Ching-Po, Feng Jianfeng, Joliot Marc. Automated anatomical labelling atlas 3. *Neuroimage*. 2020;206, 116189.
137. Woods Roger P, Grafton Scott T, Holmes Colin J, Cherry Simon R, Mazziotta John C. Automated image registration: I. general methods and intrasubject, intramodality validation. *J Comput Assist Tomogr*. 1998;22(1):139–152.
138. Ardekani Babak A, Guckemus Stephen, Bachman Alvin, Hoptman Matthew J, Wojtaszek Michelle, Nierenberg Jay. Quantitative comparison of algorithms for inter-subject registration of 3d volumetric brain mri scans. *J Neurosci Methods*. 2005;142(1):67–76.
139. Ardekani Babak A. A new approach to symmetric registration of longitudinal structural mri of the human brain. *bioRxiv*. 2018;306811.
140. Arganda-Carreras Ignacio, Sorzano Carlos OS, Kybic Jan, Ortiz-de Solorzano Carlos. *bunwarpj: consistent and elastic registration in imagej, methods and applications*. In: *Second ImageJ User & Developer Conference*. 12. 2008.
141. Wilke Marko, Altaye Mekibib, Holland Scott K, CMIND Authorship Consortium, et al.. Cerebromatic: a versatile toolbox for spline-based mri template creation. *Front Comput Neurosci*. 2017;11(5).
142. Fonov Vladimir, Dadar Mahsa, Collins D Louis, PREVENT-AD Research Group, et al.. Deep learning of quality control for stereotaxic registration of human brain mri. *bioRxiv*. 2018;303487.
143. Klein Stefan, Staring Marius, Murphy Keelin, Viergever Max A, Pluim Josien PW. Elastix: a toolbox for intensity-based medical image registration. *IEEE Trans Med Imag*. 2009;29(1):196–205.
144. Skerl Darko, Likar Bostjan, Pernus Franjo. A protocol for evaluation of similarity measures for rigid registration. *IEEE Trans Med Imag*. 2006;25(6):779–791.
145. Suk Tae Woo, Kim Sam Soo, Lee Kang Uk, Nam Eui-Cheol, Kim Keun Woo. Validation of hippocampal volumes measured using a manual method and two automated methods (freesurfer and ibaspm) in chronic major depressive disorder. *Neuroradiology*. 2008;50(7):569.
146. Deman Pierre, Bhattacharjee Manik, Tadel François, et al. Intranat electrodes: a free database and visualization software for intracranial electroencephalographic data processed for case and group studies. *Front Neuroinf*. 2018;12.
147. Erika RE Denton, Sonoda Luke I, Rueckert Daniel, et al. Comparison and evaluation of rigid, affine, and nonrigid registration of breast mr images. *J Comput Assist Tomogr*. 1999;23(5):800–805.
148. Schnabel Julia A, Rueckert Daniel, Quist Marcel, et al. A generic framework for non-rigid registration based on non-uniform multi-level free-form deformations. In: *International Conference on Medical Image Computing and Computer-Assisted Intervention*. 2001:573–581. Springer.
149. Xiao Sa, Wu Yue, Lee Aaron Y, Rokem Ariel. Mri2mri: a deep convolutional network that accurately transforms between brain mri contrasts. *bioRxiv*. 2018, 289926.
150. Ganzetti Marco, Liu Quanying, Mantini Dante. A spatial registration toolbox for structural mr imaging of the aging brain. *Neuroinformatics*. 2018;16(2):167–179.
151. Aganj Iman, Iglesias Juan Eugenio, Reuter Martin, Sabuncu Mert Rory, Fischl Bruce. Mid-space-independent deformable image registration. *Neuroimage*. 2017;152:158–170.
152. Robinson Emma C, Jbabdi Saad, Glasser Matthew F, et al. Msm: a new flexible framework for multimodal surface matching. *Neuroimage*. 2014;100:414–426.
153. D'Albis Tiziano, Haegelen Claire, Essert Caroline, Fernández-Vidal Sara, Lalys Florent, Jannin Pierre. Pydbs: an automated image processing workflow for deep brain stimulation surgery. *Int J Comput Assist Radiol Surg*. 2015;10(2): 117–128.
154. Gardey Guillaume, Lime Didier, Magnin Morgan, Romeo Olivier Roux. A tool for analyzing time petri nets. In: *International Conference on Computer Aided Verification*. Springer; 2005:418–423.
155. Aganj Iman, Fischl Bruce. Multimodal image registration through simultaneous segmentation. *IEEE Signal Process Lett*. 2017;24(11):1661–1665.
156. Ting FF, Sim KS, Lee Y. Three-dimensional model reconstruction using surface interpolation with the interfacing of hermite surface for breast cancer mri imaging system. In: *2016 International Conference on Robotics, Automation and Sciences (ICORAS)*. 2016:1–5. IEEE.
157. Avants Brian B, Tustison Nick, Song Gang, et al. Advanced normalization tools (ants). *Insight j*. 2009;2(365):1–35.
158. Van Essen David C, Drury Heather A, Dickson James, Harwell John, Hanlon Donna, Anderson Charles H. An integrated software suite for surface-based analyses of cerebral cortex. *J Am Med Inf Assoc*. 2001;8(5):443–459.
159. Uwe Barthel Kai. 3d-data representation with imagej. In: *ImageJ Conference. Citeseer*. 2006.
160. Fang Qianqian, Boas David A. Tetrahedral mesh generation from volumetric binary and grayscale images. In: *2009 IEEE International Symposium on Biomedical Imaging: From Nano to Macro*. 2009:1142–1145. Ieee.
161. Lancaster Jack L, Laird Angela R, Eickhoff Simon B, et al. Automated regional behavioral analysis for human brain images. *Front Neuroinf*. 2012;6:23.
162. van Eimeren Thilo, Monchi Oury, Ballanger Benedicte, Strafella Antonio P. Dysfunction of the default mode network in Parkinson disease: a functional magnetic resonance imaging study. *Arch Neurol*. 2009;66(7):877–883.
163. Burton Hanna E, Eisenstein Neil M, Lawless Bernard M, et al. The design of additively manufactured lattices to increase the functionality of medical implants. *Mater Sci Eng C*. 2019;94:901–908.
164. Ziad S Saad, Reynolds Richard C. Suma. *Neuroimage*. 2012;62(2):768–773.
165. Oosterhof Nikolaas N, Wiestler Tobias, Downing Paul E, Diedrichsen Jörn. A comparison of volume-based and surface-based multi-voxel pattern analysis. *Neuroimage*. 2011;56(2):593–600.
166. Jonas Larsson, Heeger David J. Two retinotopic visual areas in human lateral occipital cortex. *J Neurosci*. 2006;26(51):13128–13142.
167. Pieper Steve, Halle Michael, Kikinis Ron. 3d slicer. In: *2004 2nd IEEE International Symposium on Biomedical Imaging: Nano to Macro (IEEE Cat No. 04EX821)*. IEEE; 2004:632–635.
168. Moretti Antonio, Stirn Andrew, Marks Gabriel, Pe'er Itsik. Autoencoding topographic factors. *J Comput Biol*. 2019;26(6):546–560.
169. Sidén Per, Eklund Anders, Bolin David, Villani Mattias. Fast bayesian whole-brain fmri analysis with spatial 3d priors. *Neuroimage*. 2017;146:211–225.
170. Ni Hong, Tan Chaozhen, Feng Zhao, et al. A robust image registration interface for large volume brain atlas. *Sci Rep*. 2020;10(1):1–16.
171. Tadel François, Baillet Sylvain, Mosher John C, et al. Brainstorm: a user-friendly application for meg/eeg analysis. *Comput Intell Neurosci*. 2011;8:2011.
172. Madan Christopher R, Kensinger Elizabeth A. Cortical complexity as a measure of age-related brain atrophy. *Neuroimage*. 2016;134:617–629.

173. O'Connor James PB, Jackson Alan, Parker Geoff JM, Jayson Gordon C. Dce-mri biomarkers in the clinical evaluation of antiangiogenic and vascular disrupting agents. *Br J Cancer*. 2007;96(2):189–195.
174. Liao Wei, Wu Guo-Rong, Xu Qiang, et al. Dynamicbc: a matlab toolbox for dynamic brain connectome analysis. *Brain Connect*. 2014;4(10):780–790.
175. Ma Boyuan, Ban Xiaojuan, Su Ya, et al. Fast-finecut: grain boundary detection in microscopic images considering 3d information. *Micron*. 2019;116:5–14.
176. Schindelin Johannes, Rueden Curtis T, Hiner Mark C, et al. The imagej ecosystem: an open platform for biomedical image analysis. *Mol Reprod Dev*. 2015;82(7-8): 518–529.
177. Mata Christian, Oliver Arnau, Torrent Albert, Mammoapplet Joan Martí. An interactive java applet tool for manual annotation in medical imaging. In: *2012 IEEE 12th International Conference on Bioinformatics & Bioengineering (BIBE)*. IEEE; 2012:34–39.
178. Gorgolewski Krzysztof, Burns Christopher D, Madison Cindee, et al. Nipype: a flexible, lightweight and extensible neuroimaging data processing framework in python. *Front Neuroinf*. 2011;5(13).
179. Rokem A, Trumpis M, Perez F. Nitime: time-series analysis for neuroimaging data. In: *Proceedings of the 8th Python in Science Conference*. 2009:68–75.
180. Schrouff Jessica, Rosa Maria J, Rondina Jane M, et al. Pronto: pattern recognition for neuroimaging toolbox. *Neuroinformatics*. 2013;11(3):319–337.
181. Mata Christian, Walker Paul M, Oliver Arnau, Brunotte François, Martí Joan, Lalande Alain. Prostateanalyzer: web-based medical application for the management of prostate cancer using multiparametric mr imaging. *Inf Health Soc Care*. 2016;41(3):286–306.
182. Froeling Martijn. Qmrtools: a mathematica toolbox for quantitative mri analysis. *J Open Source Softw*. 2019;4(38):1204.
183. Winkelmann James A, Eid Aya, Spicer Graham, Almassalha Luay M, Nguyen The-Quyen, Backman Vadim. Spectral contrast optical coherence tomography angiography enables single-scan vessel imaging. *Light Sci Appl*. 2019;8(1):1–9.
184. Beczek Michał, Ryżak Magdalena, Lamorski Krzysztof, Sochan Agata, Mazur Rafał, Bieganowski Andrzej. Application of x-ray computed microtomography to soil craters formed by raindrop splash. *Geomorphology*. 2018;303:357–361.
185. Yan Kang K, Wang Xiaofei, Lam Wendy, Vardhanabhuti Varut, Lee Anne WM, Pang Herbert. Radiomics analysis using stability selection supervised principal component analysis for right-censored survival data. *bioRxiv*. 2018:408831.
186. Scott Marietta LJ, Bromiley Paul A, Thacker Neil A. Cerebral cortical thickness estimation using the TINA open-source image analysis environment. *Insight J*. 2005.
187. Guyomarc'h Pierre, Veleminsky Petr, Bruzek Jaroslav, et al. Facial approximation of tycho brahe's partial skull based on estimated data with tivmi-afa3d. *Forensic Sci Int*. 2018;292:131–137.
188. Kubota Emily C, Joo Sung Jun, Huber Elizabeth, Yeatman Jason D. Word selectivity in high-level visual cortex and reading skill. *Developmental cognitive neuroscience*. 2019;36, 100593.
189. Khullar Siddharth. *A Better Looking Brain: Image Preprocessing Approaches for fMRI Data*. Rochester Institute of Technology; 2013.
190. Zhao Yize, Kang Jian, Qi Long. Bayesian multiresolution variable selection for ultra-high dimensional neuroimaging data. *IEEE ACM Trans Comput Biol Bioinf*. 2015;15(2):537–550.
191. Close Thomas G, Ward Phillip GD, Sforazzini Francesco, Goscinski Wojtek, Chen Zhaolin, Egan Gary F. A comprehensive framework to capture the arcana of neuroimaging analysis. *Neuroinformatics*. 2018:1–21.
192. Wang Ze. Improving cerebral blood flow quantification for arterial spin labeled perfusion mri by removing residual motion artifacts and global signal fluctuations. *Magn Reson Imag*. 2012;30(10):1409–1415.
193. Kesler Shelli R, Rao Vikram, Ray William J, Rao Arvind, Alzheimer's Disease Neuroimaging Initiative, et al.. Probability of alzheimer's disease in breast cancer survivors based on gray-matter structural network efficiency. *Alzheimer's Dementia: Diagnosis, Assessment & Disease Monitoring*. 2017;9:67–75.
194. Davatzikos Christos, Rathore Saima, Bakas Spyridon, et al. Cancer imaging phenomics toolkit: quantitative imaging analytics for precision diagnostics and predictive modeling of clinical outcome. *J Med Imag*. 2018;5(1), 011018.
195. Makowski Carolina, Bodnar Michael, Malla Ashok K, Joober Ridha, Lepage Martin. Age-related cortical thickness trajectories in first episode psychosis patients presenting with early persistent negative symptoms. *NPJ schizophrenia*. 2016;2, 16029.
196. Karperien Audrey. *Fraclac for Imagej*. Charles Sturt University; 2013.
197. Hadi Hosseini SM, Hoeft Fumiko, Kesler Shelli R. Gat: a graph-theoretical analysis toolbox for analyzing between-group differences in large-scale structural and functional brain networks. *PLoS One*. 2012;7(7), e40709.
198. Hasselwander Christopher J, Cao Zhipeng, Grissom William A. gr-mri: a software package for magnetic resonance imaging using software defined radios. *J Magn Reson*. 2016;270:47–55.
199. Nečas David, Klapetek Petr. Gwyddion: an open-source software for spm data analysis. *Open Phys*. 2012;10(1):181–188.
200. Binczyk Franciszek, Stjelties Bram, Weber Christian, et al. Mimseg-an algorithm for automated detection of tumor tissue on nmr apparent diffusion coefficient maps. *Inf Sci*. 2017;384:235–248.
201. Klein Arno, Tourville Jason. 101 labeled brain images and a consistent human cortical labeling protocol. *Front Neurosci*. 2012;6:171.
202. Heath R Pardoe, Kuzniecky Ruben. Napr: a cloud-based framework for neuroanatomical age prediction. *Neuroinformatics*. 2018;16(1):43–49.
203. Westwood JD. Facilitating real-time volume interaction. Medicine meets virtual reality 11. *NextMed: Health Horizon*. 2003;94:329.
204. Brown James M, Horner Neil R, Lawson Thomas N, et al. A bioimage informatics platform for high-throughput embryo phenotyping. *Briefings Bioinf*. 2016;19(1): 41–51.
205. Wang Yizhi, DelRosso Nicole V, Vaidyanathan Trisha, et al. An event-based paradigm for analyzing fluorescent astrocyte activity uncovers novel single-cell and population-level physiology. *bioRxiv*. 2018:504217.
206. Mazaika P, Whitfield-Gabrieli S, Reiss Allan, Glover G. Artifact repair for fmri data from high motion clinical subjects. *Hum Brain Mapp*. 2007;47(58), 70238–1.
207. Kwan RK-S, Evans Alan C, Pike G Bruce. Mri simulation-based evaluation of image-processing and classification methods. *IEEE Trans Med Imag*. 1999;18(11): 1085–1097.
208. Howard Conor J, Frost Adam. Ribosome-associated quality control and cat tailing. *Crit Rev Biochem Mol Biol*. 2021;56(6):603–620.
209. Sarappa Chiara, Salvatore Elena, Filla Alessandro, et al. Functional mri signal fluctuations highlight altered resting brain activity in huntington's disease. *Brain imaging and behavior*. 2017;11(5):1459–1469.
210. Christine Föll Melanie, Moritz Lennart, Wollmann Thomas, et al. Accessible and reproducible mass spectrometry imaging data analysis in galaxy. *bioRxiv*. 2019, 628719.
211. Keshavan Anisha, Datta Esha, McDonough Ian M, Madan Christopher R, Jordan Kesshi, Henry Roland G. Mindcontrol: a web application for brain segmentation quality control. *Neuroimage*. 2018;170:365–372.
212. Esteban Oscar, Birman Daniel, Schaer Marie, Koyejo Oluwasanmi O, Poldrack Russell A, Gorgolewski Krzysztof J. Mriqc: advancing the automatic prediction of image quality in mri from unseen sites. *PLoS One*. 2017;12(9), e0184661.
213. Reza Sadri Amir, Janowczyk Andrew, Zhou Ren, et al. Mrqy—an open-source tool for quality control of mr imaging data. *Med Phys*. 2020;47(12):6029–6038.
214. Shehzad Zarrar, Giavasis Steven, Li Qingyang, et al. The preprocessed connectomes project quality assessment protocol-a resource for measuring the quality of mri data. *Front Neurosci*. 2015;47.
215. Klapwijk Eduard T, Kamp Ferdi Van De, Van Der Meulen Mara, Peters Sabine, Wierenga Lara M, Qoala-t. A supervised-learning tool for quality control of freesurfer segmented mri data. *Neuroimage*. 2019;189:116–129.
216. Rispoli Joseph V, Wright Steven M, Malloy Craig R, McDougall Mary P. Automated modification and fusion of voxel models to construct body phantoms with heterogeneous breast tissue: application to mri simulations. *J Biomed Graph Comput*. 2017;7(1):1.
217. Bach Cuadra Meritxell, Cammoun Leila, Butz Torsten, Cuisenaire Olivier, Thiran J-P. Comparison and validation of tissue modelization and statistical classification methods in t1-weighted mr brain images. *IEEE Trans Med Imag*. 2005;24(12): 1548–1565.
218. Alizadeh Somayeh, Norani Ala. Icma: a new efficient algorithm for process model discovery. *Appl Intell*. 2018;48(11):4497–4514.
219. Ramón Lopéz-Blanco José, Garzón José Ignacio, Chacón Pablo. imod: multipurpose normal mode analysis in internal coordinates. *Bioinformatics*. 2011;27(20): 2843–2850.
220. Johnsen Stian F, Taylor Zeike A, Clarkson Matthew J, et al. Niftysim: a gpu-based nonlinear finite element package for simulation of soft tissue biomechanics. *Int J Comput Assist Radiol Surg*. 2015;10(7):1077–1095.
221. Huang Yu, Datta Abhishek, Bikson Marom, Parra Lucas C. Realistic volumetric-approach to simulate transcranial electric stimulation–roast–a fully automated open-source pipeline. *J Neural Eng*. 2019.
222. Benoit-Cattin Hugues, Collewet Guylaine, Belaroussi Boubakeur, Saint-Jalmes H, Odet C. The simri project: a versatile and interactive mri simulator. *J Magn Reson*. 2005;173(1):97–115.
223. Vedula Vijay, Lee Juhyun, Xu Hao, Kuo C-C Jay, Hsiai Tzung K, Marsden Alison L. A method to quantify mechanobiologic forces during zebrafish cardiac development using 4-d light sheet imaging and computational modeling. *PLoS Comput Biol*. 2017;13(10), e1005828.
224. Wilke Marko, Holland Scott K, Altaye Mekibib, Gaser Christian. Template-o-matic: a toolbox for creating customized pediatric templates. *Neuroimage*. 2008;41(3): 903–913.
225. Antiga LADS, Steinman David A. *Vmtk: Vascular Modeling Toolkit*. San Francisco, CA: VMTK; 2006. . Accessed April 27, 2015.
226. D'Andrea Giancarlo, Angelini Albina, Romano Andrea, et al. Intraoperative dti and brain mapping for surgery of neoplasm of the motor cortex and the corticospinal tract: our protocol and series in brainsuite. *Neurosurg Rev*. 2012;35(3):401–412.
227. López-Fernández Hugo, Pessôa Gustavo S, Arruda Marco AZ, et al. La-images: a software for elemental distribution bioimaging using la–icp–ms data. *J Cheminf*. 2016;8(1):65.
228. Grotegerd Dominik, Redlich Ronny, Almeida Jorge RC, et al. Mania—a pattern classification toolbox for neuroimaging data. *Neuroinformatics*. 2014;12(3): 471–486.
229. Fonov Vladimir S, Doyle Andrew, Evans Alan C, Louis Collins D. Neuromtl iseg challenge methods. *bioRxiv*. 2018;278465.
230. Horn Andreas, Li Ningfei, Dembek Till A, et al. Lead-dbs v2: towards a comprehensive pipeline for deep brain stimulation imaging. *Neuroimage*. 2019;184: 293–316.
231. Prodanov Dimiter, Verstreken Kris. Automated segmentation and morphometry of cell and tissue structures. selected algorithms in imagej. In: *Molecular Imaging*. 2012. InTech.
232. Bonfiglio Tommaso, Biggi Federico, Bassi Anna Maria, et al. Simulated microgravity induces nuclear translocation of bax and bcl-2 in glial cultured c6 cells. *Heliyon*. 2019;5(6), e01798.

233. Fritzsche Klaus H, Neher Peter F, Reicht Ignaz, et al. Mitk diffusion imaging. *Methods Inf Med*. 2012;51(5):441–448.
234. Erhardt Erik B, Allen Elena A, Wei Yonghua, Eichele Tom, Calhoun Vince D. Simtb, a simulation toolbox for fmri data under a model of spatiotemporal separability. *Neuroimage*. 2012;59(4):4160–4167.
235. Schirner Michael, Randal McIntosh Anthony, Jirsa Viktor, et al. Bridging multiple scales in the human brain using computational modelling. *bioRxiv*. 2016, 085548.
236. D'Arceuil Helen, de Crespigny Alex. The effects of brain tissue decomposition on diffusion tensor imaging and tractography. *Neuroimage*. 2007;36(1):64–68.
237. Haneef Zulfi, Levin Harvey S, Chiang Sharon. Brain graph topology changes associated with anti-epileptic drug use. *Brain Connect*. 2015;5(5):284–291.
238. Xie Sangma, Chen Liangfu, Zuo Nianming, Jiang Tianzi. Diffusionkit: a light one-stop solution for diffusion mri data analysis. *J Neurosci Methods*. 2016;273: 107–119.
239. Frost Carlton P, Elizabeth Meyerand M, Birn Rasmus M, Hoks Roxanne M, Walsh Erin C, Abercrombie Heather C. Childhood emotional abuse moderates associations among corticomotor white matter structure and stress neuromodulators in women with and without depression. *Front Neurosci*. 2018;12: 256.
240. Aganj Iman. Automatic verification of the gradient table in diffusion-weighted mri based on fiber continuity. *Sci Rep*. 2018;8(1):1–7.
241. Hernandez-Fernandez Moises, Reguly Istvan, Jbabdi Saad, Giles Mike, Smith Stephen, Sotiropoulos Stamatios N. Using gpus to accelerate computational diffusion mri: from microstructure estimation to tractography and connectomes. *Neuroimage*. 2019;188:598–615.
242. Park Hae-Jeong. Quantification of white matter using diffusion-tensor imaging. *Int Rev Neurobiol*. 2005;66:167–212.
243. Wise Toby, Radua Joaquim, Nortje Gareth, Cleare Anthony J, Young Allan H, Arnone Danilo. Voxel-based meta-analytical evidence of structural disconnectivity in major depression and bipolar disorder. *Biol Psychiatr*. 2016;79(4):293–302.
244. Wang Ruopeng, Benner Thomas, Sorensen Alma Gregory, Wedeen Van Jay. Diffusion toolkit: a software package for diffusion imaging data processing and tractography. In: *Proc Intl Soc Mag Reson Med. Berlin*. 2007.
245. Leemans A, Jeurissen B, Sijbers J, Jones DK. Exploredti: a graphical toolbox for processing, analyzing, and visualizing diffusion mr data. In: *Proc Intl Soc Mag Reson Med*. 2009.
246. Gupta Vikash, Thomopoulos Sophia I, Corbin Conor K, Rashid Faisal, Thompson Paul M. Fibernet 2.0: an automatic neural network based tool for clustering white matter fibers in the brain. In: *2018 IEEE 15th International Symposium on Biomedical Imaging (ISBI 2018)*. IEEE; 2018:708–711.
247. Toussaint Nicolas, Souplet Jean-Christophe, Fillard Pierre, et al. Medinria: medical image navigation and research tool by inria. *Proc. of MICCAI*. 2007;7:87.
248. Tournier J-Donald, Smith Robert, Raffelt David, et al. Mrtrix3: a fast, flexible and open software framework for medical image processing and visualisation. *Neuroimage*. 2019;202, 116137.
249. Cui Zaixu, Zhong Suyu, Xu Pengfei, Gong Gaolang, He Yong. Panda: a pipeline toolbox for analyzing brain diffusion images. *Front Hum Neurosci*. 2013;7:42.
250. Smith Robert E, Tournier Jacques-Donald, Calamante Fernando, Connelly Alan. Sift2: enabling dense quantitative assessment of brain white matter connectivity using streamlines tractography. *Neuroimage*. 2015;119:338–351.
251. Norton Isaiah, Essayed Walid Ibn, Zhang Fan, et al. Slicerdmri: open source diffusion mri software for brain cancer research. *Cancer Res*. 2017;77(21): e101–e103.
252. Yeh Fang-Cheng, Panesar Sandip, Barrios Jessica, et al. Automatic removal of false connections in diffusion mri tractography using topology-informed pruning (tip). *Neurotherapeutics*. 2019;16(1):52–58.
253. Alhamud AA, Hess A, Tisdall MD, Meintjes EM, van der Kouwe AJ. *Implementation of real time motion correction in diffusion tensor imaging. Proceedings of the 19th International Society for Magnetic Resonance Society for Magnetic Resonance in Medicine*. ISMRM'11); 2011.
254. Joliot Marc, Jobard Gaël, Naveau Mikaël, et al. Aicha: an atlas of intrinsic connectivity of homotopic areas. *J Neurosci Methods*. 2015;254:46–59.
255. Nathoo Farouk S, Kong Linglong, Zhu Hongtu, Alzheimer's Disease Neuroimaging Initiative. A review of statistical methods in imaging genetics. *Can J Stat*. 2019;47 (1):108–131.
256. Kim Eun Young, Johnson Hans J. Robust multi-site mr data processing: iterative optimization of bias correction, tissue classification, and registration. *Front Neuroinf*. 2013;7:29.
257. Brainvoyager R Goebel. A program for analyzing and visualizing functional and structural magnetic resonance data sets. *Neuroimage*. 1996;3(3):S604.
258. Sherif Tarek, Rioux Pierre, Rousseau Marc-Etienne, et al. Cbrain: a web-based, distributed computing platform for collaborative neuroimaging research. *Front Neuroinf*. 2014;8(54).
259. Whitfield-Gabrieli Susan, Nieto-Castanon Alfonso. Conn: a functional connectivity toolbox for correlated and anticorrelated brain networks. *Brain Connect*. 2012;2(3): 125–141.
260. Duann JR, Jung TP, Makeig S, Sejnowski TJ. fmrlab: an ica toolbox for fmri data analysis. *NeuroImage*. 2002;16(2):2337–2372.
261. Jenkinson Mark, Beckmann Christian F, Behrens Timothy EJ, Woolrich Mark W, Smith Stephen M. Fsl. *Neuroimage*. 2012;62(2):782–790.
262. Rubin Timothy, Koyejo Oluwasanmi O, Jones Michael N, Yarkoni Tal. Generalized correspondence-lda models (gc-lda) for identifying functional regions in the brain. *Adv Neural Inf Process Syst*. 2016;29:1118–1126.
263. Zimmerer Rüdiger M, Ellis III Edward, Sanchez Aniceto Gregorio, et al. A prospective multicenter study to compare the precision of posttraumatic internal orbital reconstruction with standard preformed and individualized orbital implants. *J Cranio-Maxillofacial Surg*. 2016;44(9):1485–1497.
264. Klein Arno, Andersson Jesper, Ardekani Babak A, et al. Evaluation of 14 nonlinear deformation algorithms applied to human brain mri registration. *Neuroimage*. 2009;46(3):786–802.
265. Guell Xavier, Goncalves Mathias, Kaczmarzyk Jakub R, Gabrieli John DE, Schmahmann Jeremy D, Ghosh Satrajit S. Littlebrain: a gradient-based tool for the topographical interpretation of cerebellar neuroimaging findings. *PLoS One*. 2019; 14(1), e0210028.
266. Lohmann Gabriele, Müller Karsten, Bosch Volker, et al. Lipsia—a new software system for the evaluation of functional magnetic resonance images of the human brain. *Comput Med Imag Graph*. 2001;25(6):449–457.
267. Koenigsberg Harold W, Denny Bryan T, Fan Jin, et al. The neural correlates of anomalous habituation to negative emotional pictures in borderline and avoidant personality disorder patients. *Am J Psychiatr*. 2014;171(1):82–90.
268. Kauppi JP, Pajula J, Tohka J. A versatile software package for inter-subject correlation based analyses of fmri. *Front Neuroinf*. 2014;8.
269. Seidlitz Jakob, Sponheim Caleb, Glen Daniel, et al. A population mri brain template and analysis tools for the macaque. *Neuroimage*. 2018;170:121–131.
270. van Mourik Tim, Snoek Lukas, Knapen Tomas, Norris David G. Porcupine: a visual pipeline tool for neuroimaging analysis. *PLoS Comput Biol*. 2018;14(5), e1006064.
271. Vinken Mathieu. The adverse outcome pathway concept: a pragmatic tool in toxicology. *Toxicology*. 2013;312:158–165.
272. Barbier Michaël, Bottelbergs Astrid, Nuydens Rony, et al. Slicemap: an algorithm for automated brain region annotation. *Bioinformatics*. 2017;34(4):718–720.
273. Jiang Binghu, He Dongmei, Guo Zhiwei, Gao Zhanhui. Effect-size seed-based d mapping of resting-state fmri for persistent insomnia disorder. *Sleep Breath*. 2020; 24(2):653–659.
274. Penny William D, Friston Karl J, Ashburner John T, Kiebel Stefan J, Nichols Thomas E. *Statistical Parametric Mapping: The Analysis of Functional Brain Images*. Elsevier; 2011.
275. Sheng Jinhua, Wang Luyun, Cheng Hu, Zhou Rougang, Shi Yuchen. Strategies for multivariate analyses of imaging genetics study in alzheimer's disease. *Neurosci Lett*. 2021, 136147.
276. Robbins Shanina, Vadigepalli Rajanikanth, Schwaber James. *Single-cell Mapping and 3d Tissue Reconstruction Using Cryosection-Derived Images and Tissue Mapper Software*. 2021.
277. Aguirre Geoffrey K. Fiasco, voxbo, and medx: behind the code. *Neuroimage*. 2012; 62(2):765–767.
278. Bloom Floyd E, Kim Yung M, Young Warren G. *Brain Browser*. Elsevier; 1990.
279. Kerepesi Csaba, Szalkai Balazs, Varga Balint, Grolmusz Vince. The braingraph. org database of high resolution structural connectomes and the brain graph tools. *Cognitive Neurodynamics*. 2017;11(5):483–486.
280. Gouws Andre D, Woods Will, Millman Rebecca E, Morland Antony B, Green Gary GR. Dataviewer3d: an open-source, cross-platform multi-modal neuroimaging data visualization tool. *Front Neuroinf*. 2009;3(9).
281. Fischl Bruce. Freesurfer. *Neuroimage*. 2012;62(2):774–781.
282. Hsu Ai-Ling, Hou Ping, Johnson Jason M, et al. Iclinfmri software for integrating functional mri techniques in presurgical mapping and clinical studies. *Front Neuroinf*. 2018;12(11).
283. Pastor Luis, Bayona Sofia, Brito Juan P, et al. A unified framework for neuroscience morphological data visualization. *Appl Sci*. 2021;11(10):4652.
284. Moore Eider B, Poliakov Andrew V, Lincoln Peter, Brinkley James F. Mindseer: a portable and extensible tool for visualization of structural and functional neuroimaging data. *BMC Bioinf*. 2007;8(1):1–12.
285. Mori Susumu, Wu Dan, Ceritoglu Can, et al. Mricloud: delivering high-throughput mri neuroinformatics as cloud-based software as a service. *Comput Sci Eng*. 2016;18 (5):21–35.
286. Felsenstein O, Peled N, Hahn E, et al. Multi-modal neuroimaging analysis and visualization tool (mmvt). *arXiv preprint arXiv:1912.10079*. 2019.
287. Hoge R, Lissot A. Neurolens: an integrated visualization and analysis platform for functional and structural neuroimaging. *Proceedings of the International Society for Magnetic Resonance in Medicine*. 2004;11:1096.
288. Kutten Kwame S, Vogelstein Joshua T, Charon Nicolas, Ye Li, Deisseroth Karl, Miller Michael I. Deformably registering and annotating whole clarity brains to an atlas via masked lddmm. In: *Optics, Photonics and Digital Technologies for Imaging Applications IV*. 9896. 2016. page 989616. International Society for Optics and Photonics.
289. Sherif Tarek, Kassis Nicolas, Rousseau Marc-Étienne, Adalat Reza, Evans Alan C. Brainbrowser: distributed, web-based neurological data visualization. *Front Neuroinf*. 2015;8(89).
290. Heine Lizette, Ali Bahri Mohamed, Cavaliere Carlo, et al. Prevalence of increases in functional connectivity in visual, somatosensory and language areas in congenital blindness. *Front Neuroanat*. 2015;9:86.
291. Bakker Rembrandt, Tiesinga Paul, Kötter Rolf. The scalable brain atlas: instant web-based access to public brain atlases and related content. *Neuroinformatics*. 2015;13(3):353–366.
292. Yamakawa Hiroshi. The whole brain architecture approach: accelerating the development of artificial general intelligence by referring to the brain. *Neural Network*. 2021;144:478–495.
293. Marcus Daniel S, Olsen Timothy R, Ramaratnam Mohana, Buckner Randy L. The extensible neuroimaging archive toolkit. *Neuroinformatics*. 2007;5(1):11–33.
294. Haehn Daniel, Rannou Nicolas, Ahtam Banu, Grant Ellen, Pienaar Rudolph. Neuroimaging in the browser using the x toolkit. *Front Neuroinf*. 2014;101.

295. Allanic Marianne, Hervé Pierre-Yves, Pham Cong-Cuong, et al. Biomist: a platform for biomedical data lifecycle management of neuroimaging cohorts. *Frontiers in ICT*. 2017;3(35).
296. Vaccarino Anthony L, Dharsee Moyez, Strother Stephen, et al. Brain-code: a secure neuroinformatics platform for management, federation, sharing and analysis of multi-dimensional neuroscience data. *Front Neuroinf*. 2018;12:28.
297. Laird Angela R, Lancaster Jack J, Fox Peter T. Brainmap. *Neuroinformatics*. 2005;3 (1):65–77.
298. Li Xiangrui, Morgan Paul S, Ashburner John, Smith Jolinda, Rorden Christopher. The first step for neuroimaging data analysis: dicom to nifti conversion. *J Neurosci Methods*. 2016;264:47–56.
299. Lancaster Jack L, Tordesillas-Gutiérrez Diana, Martinez Michael, et al. Bias between mni and talairach coordinates analyzed using the icbm-152 brain template. *Hum Brain Mapp*. 2007;28(11):1194–1205.
300. Rizzo Gaia, Veronese Mattia, Expert Paul, Turkheimer Federico E, Bertoldo Alessandra. Menga: a new comprehensive tool for the integration of neuroimaging data and the allen human brain transcriptome atlas. *PLoS One*. 2016; 11(2), e0148744.
301. Yoshida Shinichi. Decoding of emotional visual stimuli using fmri brain signal. In: *2016 IEEE/ACIS 15th International Conference on Computer and Information Science (ICIS)*. 2016:1–4. IEEE.
302. Sun Jian-zhong, Wang Zhi-kang, Gong Xiang-yang, Zhou Yan, Zhou Ping. Three-dimensional reconstruction of brain surface anatomy with mricro software. *Journal of Practical Radiology*. 2006;7.
303. Rorden C, Karnath HO, Bonilha L. *Mricron dicom to nifti converter. Neuroimaging Informatics Tools and Resources Clearinghouse (NITRC)*. 2012.
304. Brett Matthew, Hanke Michael, Markiewicz Chris, et al. *nipy/nibabel: 2.3. 0. June*. 2018, 1287921, 10.5281/zenodo.
305. Gorgolewski Krzysztof, Esteban Oscar, Schaefer Gunnar, Wandell Brian, Poldrack Russell. Openneuro—a free online platform for sharing and analysis of neuroimaging data. *Organization for human brain mapping*. 2017;1677(2). Vancouver, Canada.
306. Rübel Oliver, Tritt Andrew, Dichter Benjamin, et al. Nwb: N 2.0: an accessible data standard for neurophysiology. *bioRxiv*. 2019.
307. Kain Michael, Bodin Marjolaine, Loury Simon, et al. Small animal shanoir (sas) a cloud-based solution for managing preclinical mr brain imaging studies. *Front Neuroinf*. 2020;14(20).
308. Nolf EX, Voet T, Jacobs F, Dierckx R, Lemahieu I. An open-source medical image conversion toolkit. *Eur J Nucl Med*. 2003;30(Suppl 2):S246.
309. Paul Nagy. Open source in imaging informatics. *J Digit Imag*. 2007;20(1):1–10.
310. Hewett Andrew J, Grevemeyer Hermann, Barth Andreas, Eichelberg Marco, Jensch Peter F. Conformance testing of dicom image objects. *Medical Imaging 1997: PACS Design and Evaluation: Engineering and Clinical Issues*. 1997;3035:480–487. International Society for Optics and Photonics.
311. M Van der Loo and E De Jonge. *Dcmodify: Modify Data Using Externally Defined Modification Rules*. 2018.
312. Gorgolewski Krzysztof J, Mendes Natacha, Wilfling Domenica, et al. A high resolution 7-tesla resting-state fmri test-retest dataset with cognitive and physiological measures. *Sci Data*. 2015;2(1):1–13.
313. Eichelberg Marco, Riesmeier Joerg, Wilkens Thomas, Hewett Andrew J, Barth Andreas, Jensch Peter. Ten years of medical imaging standardization and prototypical implementation: the dicom standard and the offis dicom toolkit (dcmtk). *Medical Imaging 2004: PACS and Imaging Informatics*. 2004;5371:57–68. International Society for Optics and Photonics.
314. Yi Thomas, Pan Ian, Collins Scott, et al. Dicom image analysis and archive (diana): an open-source system for clinical ai applications. *J Digit Imag*. 2021:1–9.
315. Mortajez Sareh, Tahmasbi Marziyeh, Zarei Javad, Jamshidnezhad Amir. A novel chaotic encryption scheme based on efficient secret keys and confusion technique for confidential of dicom images. *Inform Med Unlocked*. 2020;20, 100396.
316. Lee Wen-Jeng, Yang Chung-Yi, Liu Kao-Lang, Liu Hon-Man, Ching Yu-Tai, Chen Shyh-Jye. Establishing a web-based dicom teaching file authoring tool using open-source public software. *J Digit Imag*. 2005;18(3):169–175.
317. Archie Kevin A, Marcus Daniel S. Dicombrowser: software for viewing and modifying dicom metadata. *J Digit Imag*. 2012;25(5):635–645.
318. Aryanto KYE, Oudkerk M, van Ooijen PMA. Free dicom de-identification tools in clinical research: functioning and safety of patient privacy. *Eur Radiol*. 2015;25 (12):3685–3695.
319. Panchal Aditya, Keyes Roy. Su-gg-t-260: dicompyler: an open source radiation therapy research platform with a plugin architecture. *Med Phys*. 2010;37(6Part19): 3245.
320. Wu Huiqun, Liu Joseph, Zhang Siliang, et al. The development of an ophthalmologic imaging cade structured report for retinal image radiomics research. *Medical Imaging 2018: Imaging Informatics for Healthcare, Research, and Applications*. 2018;ume 10579, 1057910. International Society for Optics and Photonics.
321. Hermena Johannes, Molla Christian, Jahnena Andreas. Managing and viewing dicom images with imagej. *Proc. ImagesJConf*. 2008.
322. Fernàndez-Bayó Josep, Barbero Octavio, Rubies Carles, Sentís Melcior, Donoso Lluis. Distributing medical images with internet technologies: a dicom web server and a dicom java viewer. *Radiographics*. 2000;20(2):581–590.
323. Kabongo L, Macia I, Paloc C. Development of a commercial cross-platform dicom viewer based on open source software. *Int J Comput Assist Radiol Surg*. 2009: S29–S30.
324. Valeri Gianluca, Mazza Francesco Antonino, Maggi Stefania, et al. Open source software in a practical approach for post processing of radiologic images. *La radiologia medica*. 2015;120(3):309–323.
325. Halchenko YO, et al. *Open Source Software: Heudiconv*. 10. Zenodo; 2018.
326. Chen Guohua, Zeng Donghai. A new framework for medical image processing—medical image processing with imbra and cimg. In: *2012 5th International Conference on BioMedical Engineering and Informatics*. 2012:145–150. IEEE.
327. Edward J Escott, Rubinstein David. Free dicom image viewing and processing software for your desktop computer: what's available and what it can do for you. *Radiographics*. 2003;23(5):1341–1357.
328. McAuliffe Matthew J, Lalonde Francois M, McGarry Delia, et al. Medical image processing, analysis and visualization in clinical research. In: *Computer-Based Medical Systems, 2001. CBMS 2001. Proceedings. 14th IEEE Symposium on*. 2001: 381–386. IEEE.
329. Park Jin Seo, Jung Yong Wook. Peeled images and sectioned images from real-color volume models of foot. *Surg Radiol Anat*. 2021;43(1):37–43.
330. Mantri Manisha, Taran Shruti, Sunder Gaur. Dicom integration libraries for medical image interoperability: a technical review. *IEEE Rev Biomed Eng*. 2020;15.
331. Jodogne Sébastien, Sobczak Sonia, Devillers Magali, Lenaerts Eric, Martinive Philippe, Coucke Philippe. Orthanc-lightweight, scriptable dicom server for medical image management in radiotherapy. *Radiother Oncol*. 2013;106(2): S488.
332. Dzwonkowski Mariusz, Rykaczewski Roman. Secure quaternion feistel cipher for dicom images. *IEEE Trans Image Process*. 2018;28(1):371–380.
333. Zhao Liang, Li Chang-Hua, Dang Fa-Ning, Li Chu-Jun, Duan Zhong-Xing. Concrete ct image quick three-dimensional reconstruction research. *Int J Pattern Recogn Artif Intell*. 2017;31(10), 1757005.
334. Seroul Pierre, Sarrut David. Vv: a viewer for the evaluation of 4d image registration. In: *MIDAS Journal (Medical Image Computing and Computer-Assisted Intervention MICCAI'2008, Workshop-Systems and Architectures for Computer Assisted Interventions)*. New York: Springer; 2008:1–8.
335. Lee Sangkyun, Papanikolaou Amalia, Logothetis Nikos K, Smirnakis Stelios M, Keliris Georgios A. A new method for estimating population receptive field topography in visual cortex. *Neuroimage*. 2013;81:144–157.
336. Li L, LaBarbera DV, Aurora CO, et al. 3d high-content screening of organoids for drug discovery. *Compr. Med. Chem.* 2017;III:388–415.
337. Cointepas Yann, Mangin Jean-François, Garnero Line, et al. Brainvisa: software platform for visualization and analysis of multi-modality brain data. *Neuroimage*. 2001;13(6):98.