Data in Brief 41 (2022) 107904

Contents lists available at ScienceDirect

Data in Brief

journal homepage: www.elsevier.com/locate/dib

Data Article

The JNU-IFM dataset for segmenting pubic symphysis-fetal head

Yaosheng Lu[a,1], Mengqiang Zhou[a,1], Dengjiang Zhi[a,1], Minghong Zhou[a,1], Xiaosong Jiang[a], Ruiyu Qiu[a], Zhanhong Ou[a], Huijin Wang[a], Di Qiu[b], Mei Zhong[c], Xiaoxing Lu[d], Gaowen Chen[e], Jieyun Bai[a,*]

[a] College of Information Science and Technology, Jinan University, Guangzhou 510632, China
[b] The First Affiliated Hospital of Jinan University, Guangzhou 510632, China
[c] NanFang Hospital of Southern Medical University, Guangzhou 510515, China
[d] Lian-Med Technology Co., Ltd, Guangzhou 510000, China
[e] Obstetrics and Gynecology Center, Zhujiang Hospital, Southern Medical University, Guangzhou 510260, China

ARTICLE INFO

Article history:
Received 27 October 2021
Revised 21 January 2022
Accepted 27 January 2022
Available online 2 February 2022

Keywords:
Pubic symphysis
Fetal head
Angle of progression
Intrapartum transperineal ultrasound

ABSTRACT

The use of transperineal ultrasound techniques for the assessment of fetal head descent and progression is an adjunct to clinical examination. Automatic identification of parameters based on ultrasound images will greatly reduce the subjectivity and non-repeatability of the clinician's judgment. However, the lack of a pubic symphysis-fetal head dataset hinders the development of algorithms. Here, we present an intrapartum transperineal ultrasound dataset of the Intelligent Fetal Monitoring Lab of Jinan University (named the JNU-IFM dataset), in which intrapartum transperineal ultrasound videos of 78 were recorded from 51 patients. These data were obtained with the Youkey D8 wireless 2D ultrasound probe with its corresponding supporting software by Wuhan Youkey Bio-Medical Electronics Co., Ltd., Wuhan, China. In these videos, 6224 high-quality images with four categories were selected to form the JNU- IFM dataset. These images were labelled using the Pair software and then validated by two experienced radiologists. We hope that this

* Corresponding author.
E-mail address: baijieyun@jnu.edu.cn (J. Bai).
[1] These authors contributed equally to this work.

https://doi.org/10.1016/j.dib.2022.107904

data set can be used in the segmentation of the pubic symphysis-fetal head.

Specifications Table

Subject	Obstetrics, Midwifery and Women's Health
Specific subject area	The use of transperineal ultrasound techniques for the assessment of fetal head descent and progression is an adjunct to clinical examination.
Type of data	Image Table
How the data were acquired	Data was obtained from transperineal ultrasound examinations that were performed in standard B-mode ultrasound using the Youkey D8 wireless 2D ultrasound probe with its corresponding supporting software (Wuhan Youkey Bio-Medical Electronics Co., Ltd., Wuhan, China). Data were labelled using the Pair software (Shenzhen Duying Medical Technology Co., Ltd., Shenzen, China) and then validated by two experienced radiologists.
Data format	Raw Analyzed
Parameters for data collection	The dataset includes intrapartum transperineal ultrasound (ITU) images and the corresponding segmentation labels of symphysis pubis (SP)-fetal head. In addition, four categories respectively corresponding to SP-fetal head images (SPHead) and other images (None: no SP and fetal head, OnlySP: no fetal head and OnlyHead: no SP) are included.
Description of data collection	The transducer was prepped by covering it with a surgical latex glove filled with coupling gel, then the prepped transducer, after applying gel, was placed between labia below the pubic symphysis to obtain a sagittal plane, small adjustments in the form of lateral movements of the probe were made until an image obtained showed clear maternal pelvic (pubic symphysis) and fetal (fetal skull) landmarks that did not show any shadows from the pubic rami. A total of 78 videos from 51 pregnant women were collected from NanFang Hospital of Southern Medical University between 2019 and early 2020. 6224 images are extracted from videos in 10 frames each. Images were labelled by using the software Pair.
Data source location	College of Information Science and Technology, Jinan University, Guangzhou, 510,632, China.
Data accessibility	Repository name: JNU-IFM Data identification number: https://10.6084/m9.figshare.14371652
Related research article	Zhou M, Yuan C, Chen Z, et al. Automatic Angle of Progress Measurement of Intrapartum Transperineal Ultrasound Image with Deep Learning[C]//International Conference on Medical Image Computing and Computer-Assisted Intervention. Springer, Cham, 2020: 406–414.10.1007/978-3-030-59725-2_39

Value of the Data

- The use of intrapartum transperineal ultrasound (ITU) techniques for the assessment of fetal head descent and progression is an adjunct to clinical examination. Compared with subjective judgment and uncertain reproducibility of clinical examination, ITU has the advantages of being well reproducible and objective.
- Manual segmentation of symphysis pubis (SP)-fetal head from ITU images for clinical radiologists is considered as the most reliable but extremely time-consuming procedure prone to subjectivity and large inter-observer variability. With the rapid development of artificial intelligence in medical images, automatic measurement algorithms based on ITU images are expected to solve the above problems.

- This dataset with ITU images and their labels is useful for developing and evaluating automated SP-fetal head segmentation algorithms and image classification algorithms. Although the SP-fetal head identification plays an important role in computing angle of progression (AoP) to assess the descent of the fetal head during labor, this dataset can also be used as objective and quantitative indicators for evaluating other ITU parameters and tracking their efficacy.

1. Data Description

This dataset is publicly available at https://doi.org/10.6084/m9.figshare.14371652, which can be downloaded as a zip file. In the unzip file, 78 files are named as "AAAABBCCTDDEEFF" which is the time when the data was obtained. In detail, AAAA, BB, CC, DD, EE and FF represents year, month, day, hour, minute and second, respectively. In the "AAAABBCCTDDEEFF" file, three folders named as "image", "mask", and "frame_label.csv" are listed. The "image" folder contains the original images which are saved in the PNG format and named as "AAAABBCCTDDEEFF_G.png" (G indicates which frame the image is in the video). And the "mask" folder contains the labels of the corresponding images in the "image" folder and these labels are named as "AAAABBCCTDDEEFF_G_mask.png". Consequently, the frame number ("G") and the frame label (3: None, 4: OnlySP, 5: OnlyHead or 6: SPHead) are, respectively, stored in the "frame_id" and "frame_label" columns of the file "frame_label.csv". It is worth noting that the image in the "mask" folder may appear to be an all-black image due to the low label value (SP: pixel value of 7, Head: pixel value of 8, and the remaining pixel values of 0). The numbers of four types of images from each patient are listed in Table 1. There are 6224 images, including 1022 images with the None label, 323 images with the OnlySP label, 1136 images with the OnlyHead label and 3743 images with the SPHead label.

Schematic display generated by angle of progression (AoP) are shown in Fig. 1.

Examples (None, OnlySP, OnlyHead and SPHead) of the original ("Image") and label ("Mask") images are shown in Fig. 2. The pixel values corresponding to SP and Head are enhanced ("Enhanced mask") here to be close to the style marked with Pair software, to facilitate the reader's understanding of the dataset.

2. Experimental Design, Materials and Methods

A total of 78 videos from 51 pregnant women were collected from NanFang Hospital of Southern Medical University between 2019 and early 2020. This study was approved by the Medical Ethics Committee of NanFang Hospital of Southern Medical University (NFCE-2019–024). All authors confirm that we have complied with all relevant ethical regulations.

Transperineal ultrasound examinations were performed in standard B-mode ultrasound using the Youkey D8 wireless 2D ultrasound probe with its corresponding supporting software (Wuhan Youkey Bio-Medical Electronics Co., Ltd., Wuhan, China), which has a 3.53± 0.0525 MHz convex probe installed. The spatial resolution of the ultrasound system is specified by the manufacturer to less than 2 mm. The overall geometric inaccuracy of a very similar setup due to inherent technical limitations was measured to be <2.0 mm laterally, <2.0 mm vertically, <2.0 mm longitudinally, and <8.0 mm radially ('vector length' or Euclidean '3D-distance'; the square root of the sum of squares of the three axes) consisting of random errors (per single measurement point) and systematic errors (effectively, per fraction). The temporal resolution of the device is specified to about 27 Hz.

In order to obtain high-quality images, the transducer was prepped by covering it with a surgical latex glove filled with coupling gel, then the prepped transducer, after applying gel, was placed between labia below the pubic symphysis to obtain a sagittal plane, small adjustments in the form of lateral movements of the probe were made until an image obtained showed

Table 1
Summary of the JNU- IFM dataset. The names of the folder of images obtained from each patient and the corresponding numbers of images in each category are given.

Patient	None	OnlyHead	OnlySP	SPHead	Files
1	11	0	96	0	20190830T115515
					20190830T115602
					20190830T115644
2	0	0	9	0	20190904T101559
3	51	0	67	8	20190906T105145
					20190906T105237
4	17	2	13	41	20190909T155747
5	26	10	3	106	20190909T161453
					20190909T161601
6	42	0	40	26	20190911T104437
					20190911T105058
7	0	0	53	0	20190911T111121
8	42	11	26	31	20190916T104520
9	28	0	23	98	20190916T105526
					20190916T105641
10	11	0	0	63	20190916T110257
11	0	0	0	30	20190916T112312
12	12	0	4	58	20190918T115054
13	11	0	108	75	20190918T120011
					20190918T120628
					20190918T120708
14	29	0	26	137	20190918T123342
					20190918T123437
15	123	0	92	0	20190922T101601
16	0	0	69	0	20190923T173644
17	4	0	68	0	20190923T175155
18	16	10	0	50	20190930T110010
19	4	2	0	66	20191003T173034
20	2	0	1	70	20191008T112326
21	0	0	0	127	20191008T114159
					20191008T114249
22	11	0	2	62	20191026T195815
23	4	0	0	75	20191108T114950
24	2	0	0	145	20191115T105623
					20191115T105730
25	2	0	65	7	20191115T110256
26	3	7	0	65	20191115T112747
27	8	0	64	1	20191115T114514
28	11	14	0	121	20191127T110323
					20191127T110427
29	5	69	0	0	20191127T111516
30	0	2	0	119	20191127T112700
					20191127T112757
31	14	1	0	132	20191127T113658
					20191127T113821
32	18	17	9	106	20191129T103133
					20191129T103822
33	0	5	0	70	20191129T105514
34	17	8	11	118	20191129T110558
					20191129T110732
35	26	8	14	24	20191203T105250
36	13	0	0	131	20191203T111627
					20191203T111732

(*continued on next page*)

Table 1 (*continued*)

Patient	None	OnlyHead	OnlySP	SPHead	Files
37	16	0	95	39	20191205T103749 20191205T103904
38	16	4	0	134	20191208T164549 20191208T165241
39	16	19	18	24	20191208T170945
40	26	0	0	49	20191212T102143
41	23	0	7	118	20191212T103205 20191212T103310
42	26	0	39	11	20191214T100241
43	25	0	3	46	20191214T103803
44	7	22	47	59	20191218T104745 20191218T104848
45	15	44	3	160	20191218T105735 20191218T105909 20191218T110113
46	66	0	6	0	20191220T102712
47	74	0	1	0	20191220T104055
48	43	0	46	33	20191220T112002 20191220T112127
49	30	2	5	115	20191220T113126 20191220T113230
50	58	34	3	696	20200103T102623 20200103T102728
51	18	32	0	97	20200103T104919 20200103T105033

clear maternal pelvic (pubic symphysis) and fetal (fetal skull) landmarks that did not show any shadows from the pubic rami [1–9]. Videos were in the MP4 format, with a resolution of 1920 × 1080. 6224 images are extracted from videos in 10 frames each. The mp4 is lossy compression or noise present in the mp4. However, we cannot remove noise because we export the data using the software that comes with the ultrasound instrument. It is worth noting that the image in the folder "image" has been preprocessed basically, and the original interface toolbar and text information of the image have been removed through cutting and overwriting operations. After processing, the resolution is 1295 × 1026. In order to prevent information loss, no downsampling is conducted. At the same time, it has been converted into a grayscale image, which can be read directly.

Ground truth is performed to make the ultrasound dataset beneficial. The software Pair (Shenzhen Duying Medical Technology Co., Ltd., Shenzen, China) is used to perform this step. According to suggestions of radiologists, the following points in the image annotation were abided: (1) In an ideal situation, the SP and fetal head are elliptical in the two-dimensional image; (2) In grayscale ultrasound images, the outer borders of the SP and fetal head mainly appear bright white. When there is no obvious white border, the boundary is determined according to the difference of the local gray value; and (3) The lower right corner of the pubic symphysis is adjacent to the bladder, and the boundary of the pubic symphysis should be determined with the bottom edge of the white area [1,5–13]. Following these points, all the segmentation labels were independently created with the software Pair by five students and visually reviewed independently by two radiologists to ensure accuracy. An example of mask images is shown in Fig. 3. Each was firstly loaded in the Pair software (Fig. 3A), images were then selected from videos in 10 frames each (Fig. 3B) and regions of the SP (Fig. 3C) and fetal head (Fig. 3D) were finally labeled.

Pair software directly generates "*.tar" files, and after decompression, "*.json" and "*.nii" files are generated. The "*.json" file records the coordinates of the key points on the contour, and the "*.nii" records the mask corresponding to the contour, whose value is the category id value set in the configuration file. Further, we set the SP pixel value in the mask to 7, and the pixel

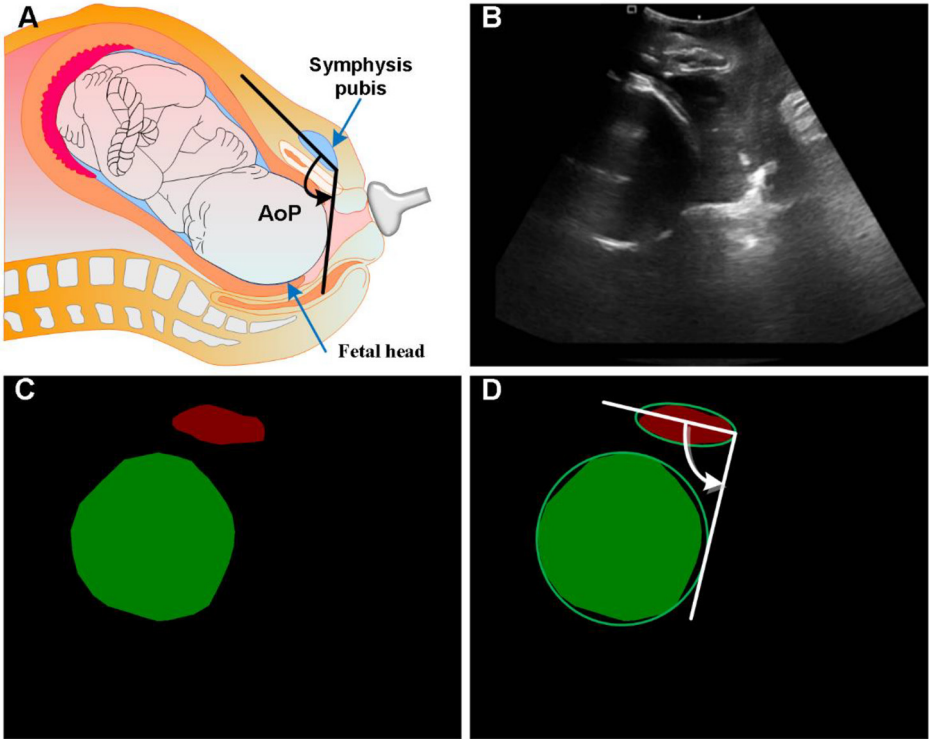

Fig. 1. Transperineal ultrasound to measure the angle of progression (AoP) formed between a straight line drawn along the longitudinal axis of the symphysis pubis (SP) and a line running from the inferior edge of SP to the leading edge of the fetal head. (A)Schematic diagram of calculating AoP; (B) An image with symphysis pubis and fetal head; (C) The segmentation result of the symphysis pubis (red) and fetal head (green); (D) Calculate AoP by elliptic function fitting.

value of the Head to 8 to generate each label. Read the classification of different labels through "FrameLabel" in the "*.json" file (3: None, 4: OnlySP, 5: OnlyHead or 6: SPHead). Finally we convert the grayscale image to an RGB image (SP is red, Head is green). For the configuration parameters of the Pair software and the label reading code, we will provide the corresponding configuration files and codes in https://github.com/JNU-IFM/JNU-IFM-config-and-code.git.

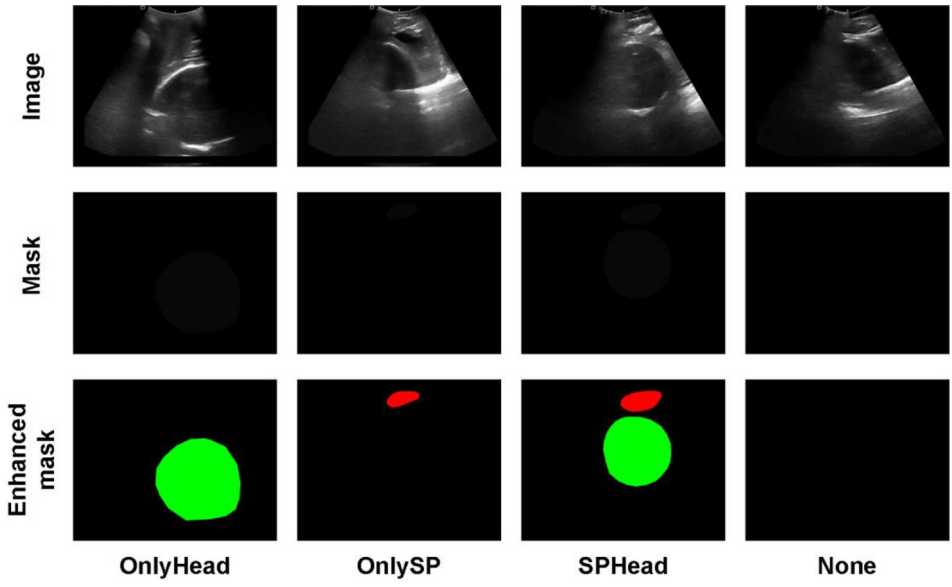

Fig. 2. Examples (None, OnlySP, OnlyHead and SPHead) of the original ("Image"), label ("Mask") and enhanced label ("Enhanced mask") images.

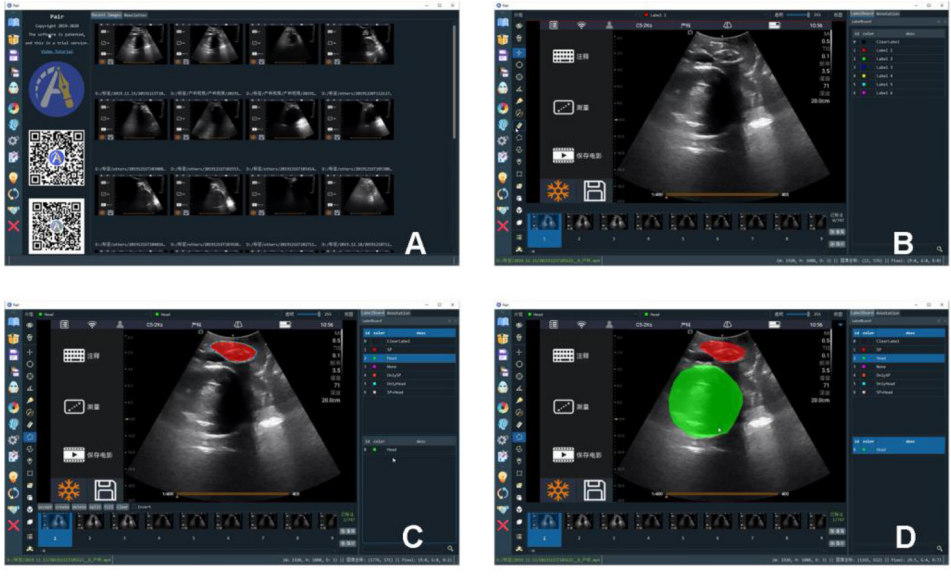

Fig. 3. An example to help illustrate the label acquisition process using the Pair software. (A) Videos were loaded in the Pair software; (B)An image from a video was selected to label regions of the symphysis pubis and fetal head; (C) The symphysis pubis was labeled with red; (D) The fetal head was labeled with green.

Ethics Statements

This study was approved by the Medical Ethics Committee of NanFang Hospital of Southern Medical University (NFCE-2019–024).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT Author Statement

Yaosheng Lu: Conceptualization, Writing – original draft; **Mengqiang Zhou:** Investigation, Methodology, Visualization, Formal analysis, Writing – original draft; **Dengjiang Zhi:** Methodology, Visualization, Formal analysis, Writing – original draft; **Minghong Zhou:** Investigation, Methodology, Visualization, Formal analysis, Writing – original draft; **Xiaosong Jiang:** Methodology, Visualization, Formal analysis, Writing – original draft; **Ruiyu Qiu:** Investigation, Writing – original draft; **Zhanhong Ou:** Writing – original draft; **Huijin Wang:** Writing – original draft; **Di Qiu:** Data curation, Investigation, Writing – original draft; **Mei Zhong:** Investigation, Methodology, Visualization, Formal analysis, Writing – original draft; **Xiaoxing Lu:** Conceptualization, Writing – original draft; **Gaowen Chen:** Writing – original draft; **Jieyun Bai:** Conceptualization, Methodology, Visualization, Formal analysis, Writing – original draft.

Acknowledgments

This research was funded by National Key Research and Development Project (2019YFC0120100, 2019YFC0121907 and 2019YFC0121904) (H.W., J.B. and Y.L.), Guangdong Provincial Key Laboratory of Traditional Chinese Medicine Informatization (2021B1212040007) and the National Natural Science Foundation of China (61901192) (J.B.), and the Entrepreneurial and Innovative Leading Talent of Guangzhou Huangpu District and Guangzhou Development District (2020–2016) (X.L.). We would thank Ms. Yijie Zhu for collecting data.

Supplementary Materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.dib.2022.107904.

References

[1] K.H. Ahn, M.J. Oh, Intrapartum ultrasound: a useful method for evaluating labor progress and predicting operative vaginal delivery, Obstet. Gynecol. Sci. 57 (6) (2014) 427–435, doi:10.5468/ogs.2014.57.6.427.
[2] A. Youssef, G. Salsi, E. Montaguti, F. Bellussi, G. Pacella, C. Azzarone, A. Farina, N. Rizzo, G. Pilu, Automated measurement of the angle of progression in labor: a feasibility and reliability study, Fetal Diagn. Ther. 41 (4) (2017) 293–299, doi:10.1159/000448947.
[3] A. Youssef, E. Maroni, A. Ragusa, F. De Musso, G. Salsi, M. Iammarino, A. Paccapelo, N. Rizzo, G. Pilu, T. Ghi, Fetal head–symphysis distance: a simple and reliable ultrasound index of fetal head station in labor, Ultrasound Obstet. Gynecol. 41 (4) (2013) 419–424, doi:10.1002/uog.12335.
[4] E. Torkildsen, K. Salvesen, T.M. Eggebø, Agreement between two-and three-dimensional transperineal ultrasound methods in assessing fetal head descent in the first stage of labor, Ultrasound Obstet. Gynecol. 39 (3) (2012) 310–315, doi:10.1002/uog.9065.
[5] A.M. Dückelmann, C. Bamberg, S.A.M. Michaelis, J. Lange, A. Nonnenmacher, J.W. Dudenhausen, K.D. Kalache, Measurement of fetal head descent using the 'angle of progression'on transperineal ultrasound imaging is reliable regardless of fetal head station or ultrasound expertise, Ultrasound Obstet. Gynecol. 35 (2) (2010) 216–222, doi:10.1002/uog.7521.

[6] B. Tutschek, T. Braun, F. Chantraine, W. Henrich, A study of progress of labour using intrapartum translabial ultrasound, assessing head station, direction, and angle of descent, BJOG Int. J. Obstet. Gynaecol. 118 (1) (2011) 62–69, doi:10.1111/j.1471-0528.2010.02775.x.
[7] T. Ghi, A. Farina, A. Pedrazzi, N. Rizzo, G. Pelusi, G. Pilu, Diagnosis of station and rotation of the fetal head in the second stage of labor with intrapartum translabial ultrasound, Ultrasound Obstet. Gynecol. Off. J. Int. Soc. Ultrasound Obstet. Gynecol. 33 (3) (2009) 331–336, doi:10.1002/uog.6313.
[8] T.M. Eggebø, L.K. Gjessing, C. Heien, E. Smedvig, I. Økland, P. Romundstad, K.A. Salvesen, Prediction of labor and delivery by transperineal ultrasound in pregnancies with prelabor rupture of membranes at term, Ultrasound Obstet. Gynecol. Off. J. Int. Soc. Ultrasound Obstet. Gynecol. 27 (4) (2006) 387–391, doi:10.1002/uog.2744.
[9] A.F. Barbera, F. Imani, T. Becker, D.C. Lezotte, J.C. Hobbins, Anatomic relationship between the pubic symphysis and ischial spines and its clinical significance in the assessment of fetal head engagement and station during labor, Ultrasound Obstet. Gynecol. Off. J. Int. Soc. Ultrasound Obstet. Gynecol. 33 (3) (2009) 320–325, doi:10.1002/uog.6322.
[10] A. Youssef, F. Bellussi, E. Maroni, G. Pilu, N. Rizzo, T. Ghi, Ultrasound in labor: is it time for a more simplified approach? Ultrasound Obstet. Gynecol. 41 (6) (2013) 710–711, doi:10.1002/uog.12373.
[11] M. Zhou, C. Yuan, Z. Chen, C. Wang, Y. Lu, Automatic angle of progress measurement of intrapartum transperineal ultrasound image with deep learning, in: Medical Image Computing and Computer Assisted Intervention Society, Springer, 2020, pp. 406–414.
[12] F. Conversano, M. Peccarisi, P. Pisani, M. Di Paola, T. De Marco, R. Franchini, A. Greco, G. D'Ambrogio, S. Casciaro, Automatic ultrasound technique to measure angle of progression during labor, Ultrasound Obstet. Gynecol. 50 (6) (2017) 766–775, doi:10.1002/uog.17441.
[13] A.F. Barbera, X. Pombar, G. Perugino, D.C. Lezotte, J.C. Hobbins, A new method to assess fetal head descent in labor with transperineal ultrasound, Ultrasound Obstet. Gynecol. 33 (3) (2009) 313–319, doi:10.1002/uog.6329.