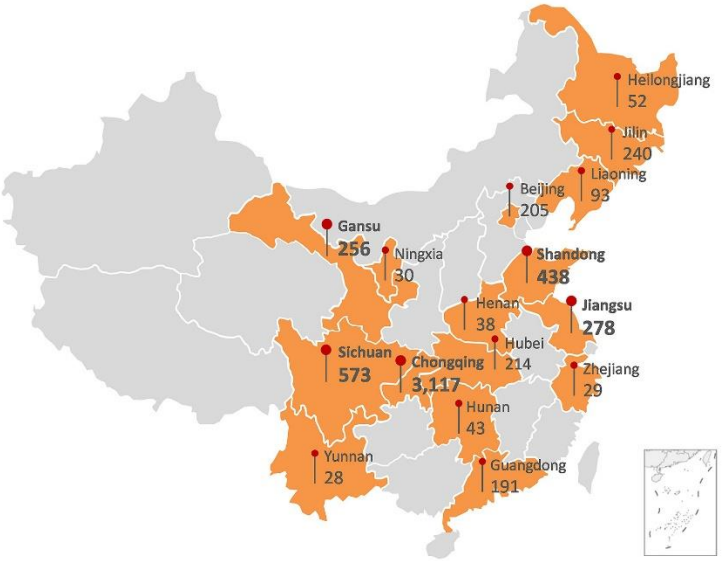
Supplementary Online Content

Xie X, Xiao YF, Zhao XY, et al. Development and validation of an artificial intelligence model for small bowel capsule endoscopy video review. *JAMA Netw Open.* 2022;5(7):e2221992. doi:10.1001/jamanetworkopen.2022.21992

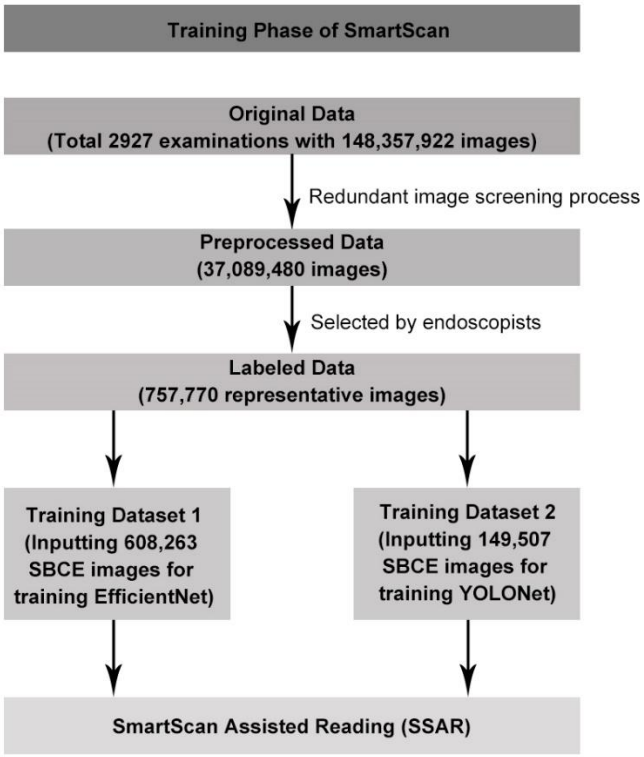
This supplementary material has been provided by the authors to give readers additional information about their work.

eFigure 1. Geographical Distribution of Centers and Included Cases

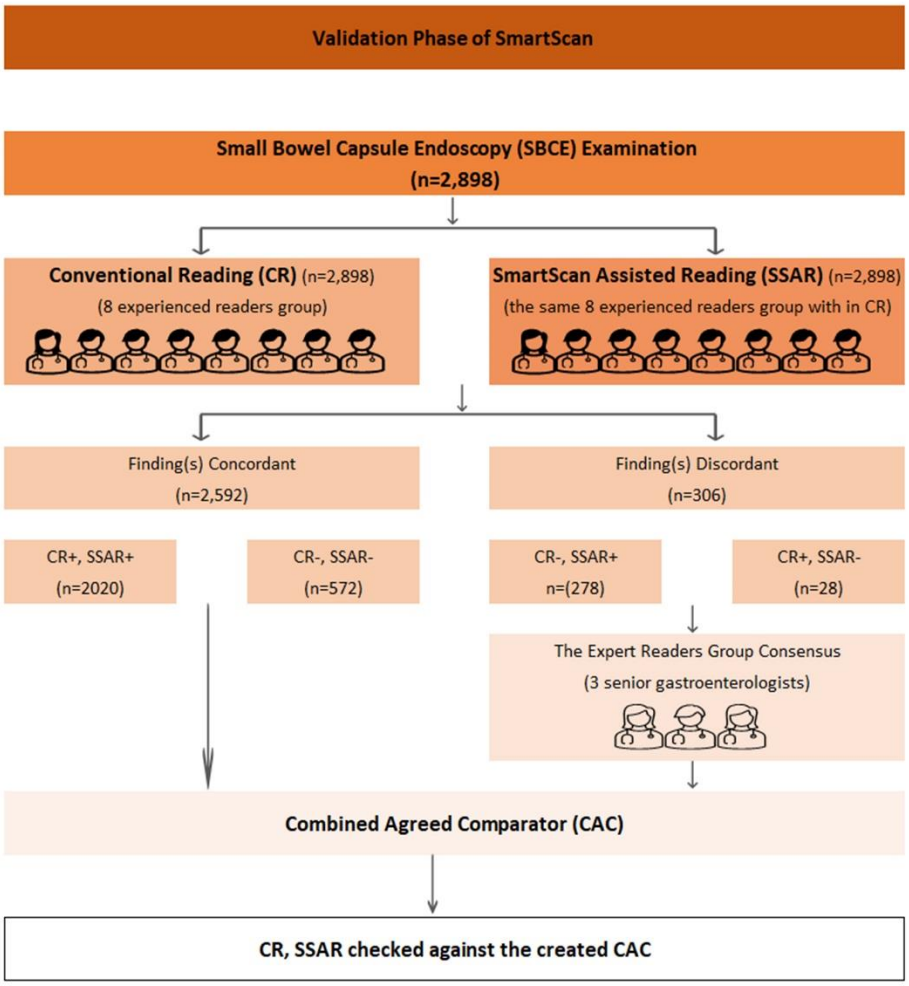


No.	Province	Cases
1	**Chongqing**	**3,117**
2	**Sichuan**	**573**
3	**Shandong**	**438**
4	**Jiangsu**	**278**
5	**Gansu**	**256**
6	Jilin	240
7	Hubei	214
8	Beijing	205
9	Guangdong	191
10	Liaoning	93
11	Heilongjiang	52
12	Hunan	43
13	Henan	38
14	Ningxia	30
15	Zhejiang	29
16	Yunnan	28
	Total:	5,825

eFigure 2. Study Flow Chart of Training Phase



eFigure 3. Study Flow Chart of Validation Phase

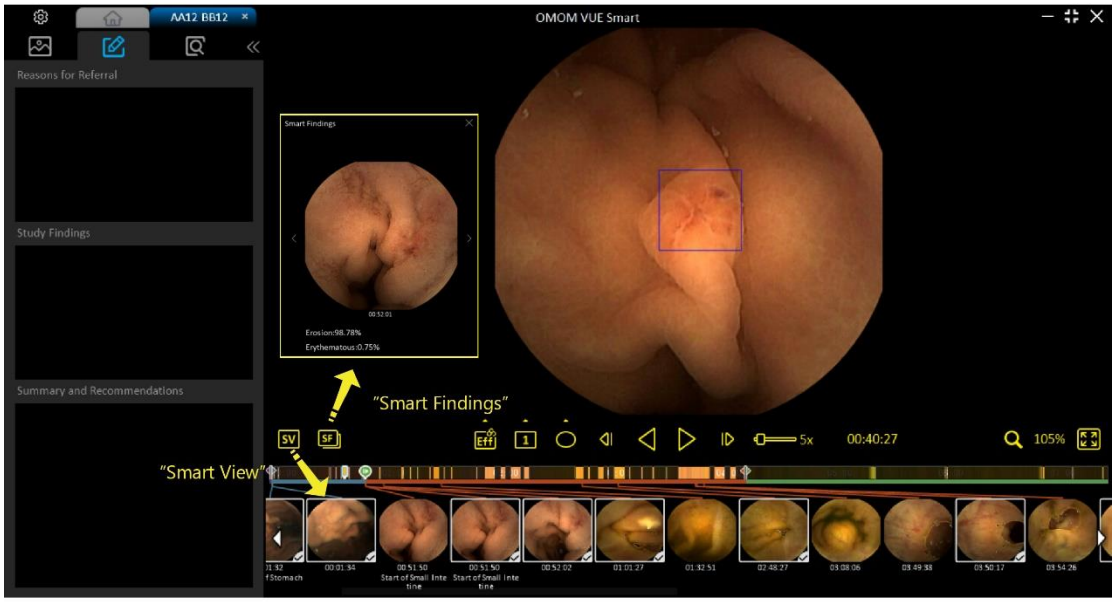


eFigure 4. Capsule Endoscopy System and Software. (A) Hardware of Capsule Endoscopy; (B) Main Interface of software; (C) “SmartView” & ”SmartFindings”.

(JS-MEC-I) (JS-MEC-II)

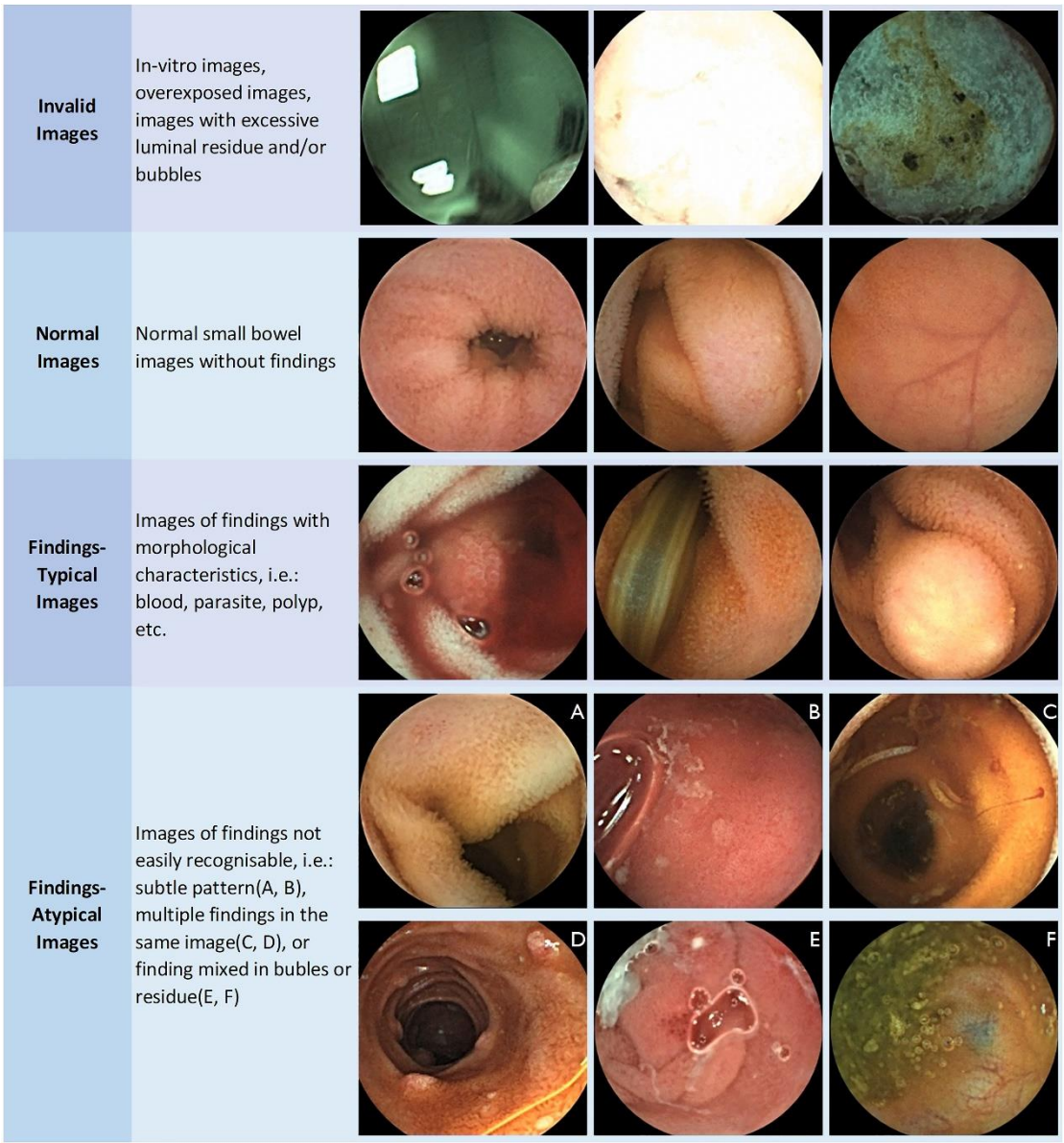
A. Hardware of Capsule Endoscopy

B. Main Interface of Software

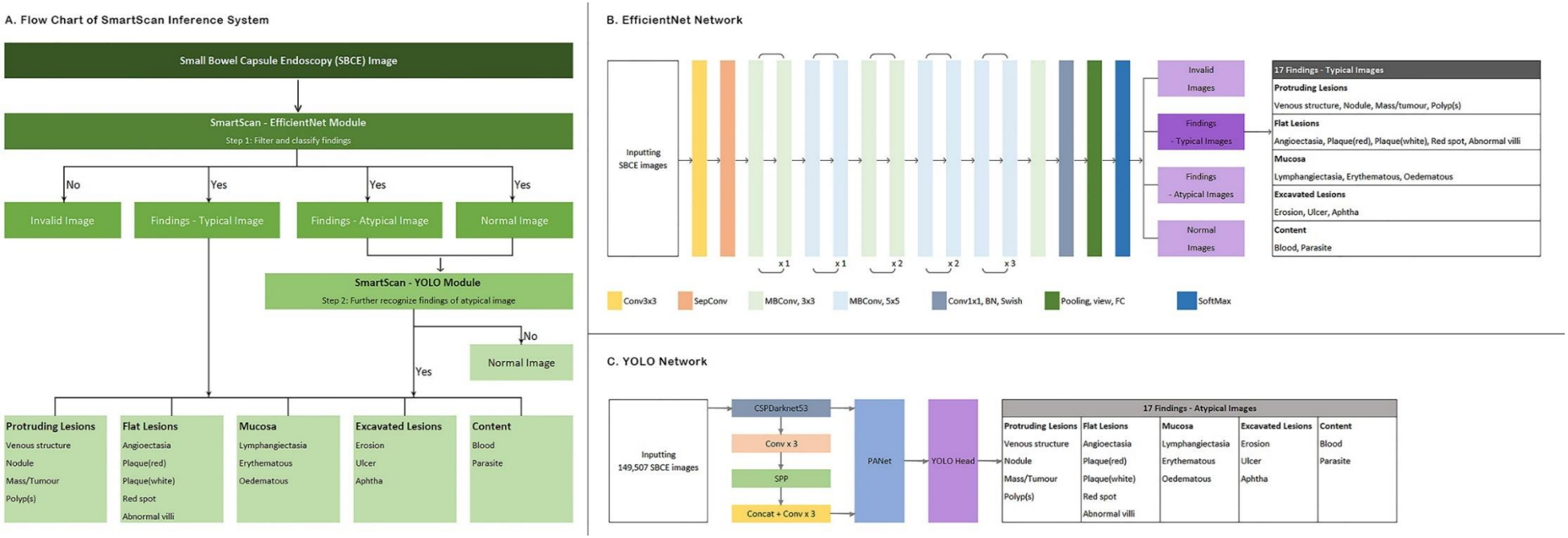


C. “SmartView” &”SmartFinding”

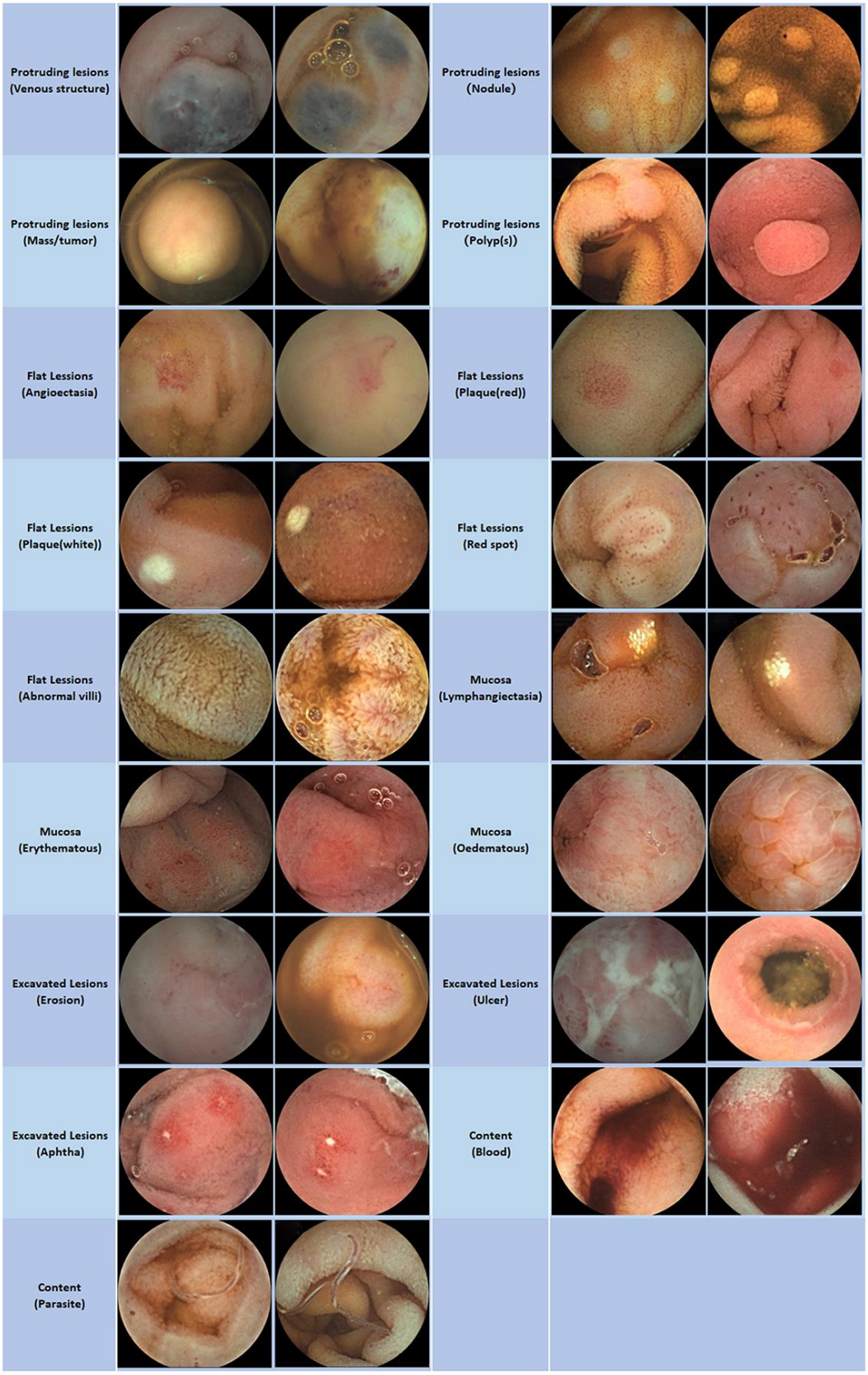
eFigure 5. Normal Images, Invalid Images, Findings-Typical Images, and Findings-Atypical Images



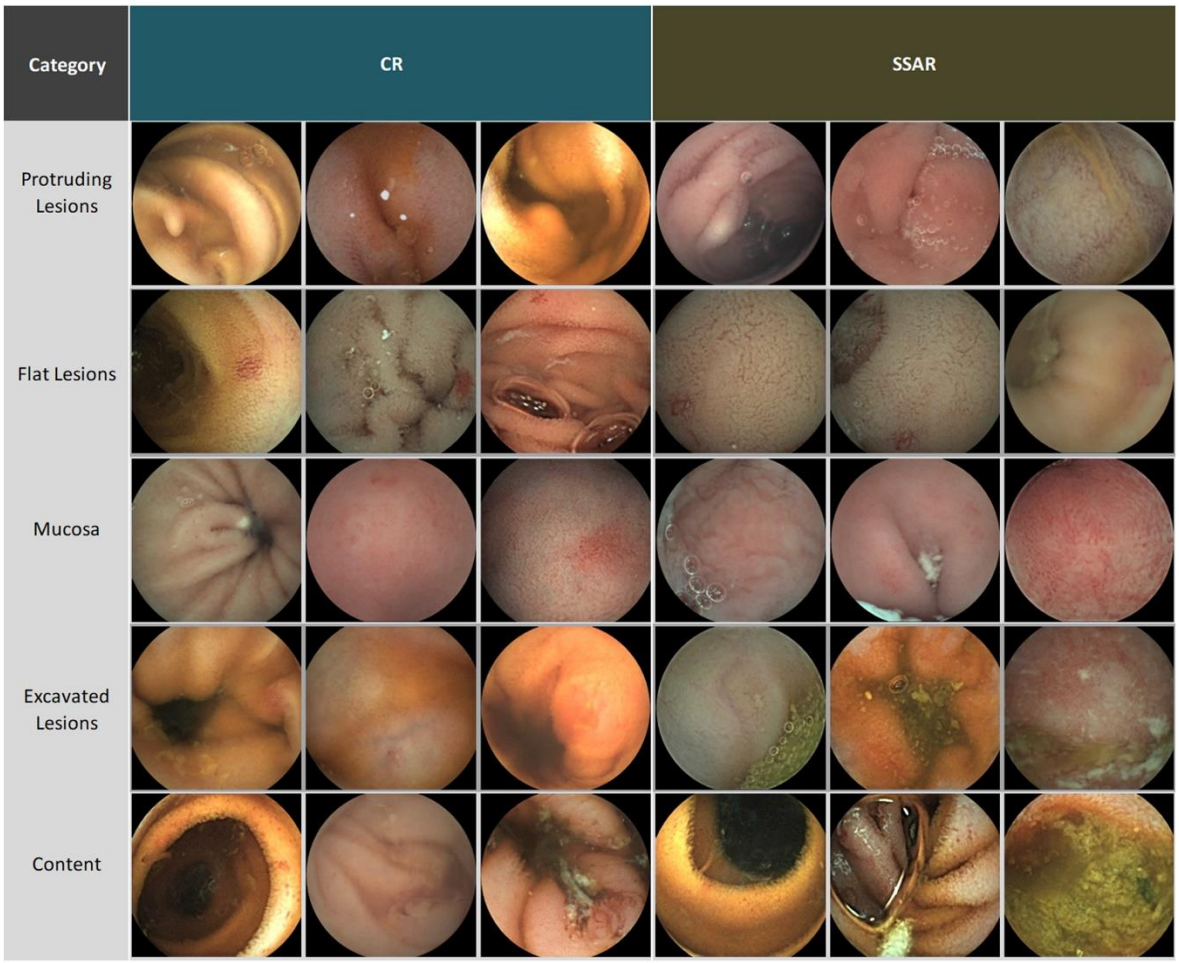
eFigure 6. Flow Chart of *SmartScan* Inference System. (A) Flow Chart of *SmartScan* Inference System; (B) EfficientNet Network; (C) YOLO Network.



eFigure 7. The 17 Findings Detected by *SmartScan* Assisted Reading (SSAR)



eFigure 8. Missed Findings by Conventional Reading (CR) and *SmartScan*-Assisted Reading (SSAR)



eTable 1. Detailed Information of Patients in the Validation Set

Name of Hospital	Number of included studies	Number of patients enrolled	Number of excluded cases
Chengdu Military Region General Hospital	74	80	6
Henan Provincial People's Hospital	38	40	2
Heilongjiang Provincial People's Hospital	27	29	2
Hubei Provincial People's Hospital	190	192	2
West China Hospital	48	49	1
Bahun First Hospital of Jilin University	179	179	0
PLA Air Force General Hospital	30	31	1
The Second Affiliated Hospital of Lanzhou University	32	34	2
The First Affiliated Hospital of Lanzhou University	57	70	13
Daping Hospital, Army Military Medical University	24	24	0
Xinqiao Hospital, Army Military Medical University	994	1023	29
Nanchuan hospital	208	223	15
Southern Hospital	173	174	1
General Hospital of Nanjing Military Region	200	272	72
Ningxia Kangyuan anorectal Hospital	11	11	0
Ningxia Medical University General Hospital	19	19	0
Qilu Hospital of Shandong Province, China	397	456	59
Sichuan Provincial People's Hospital	28	29	1
Hospital of Southwest Medical University	49	56	7
The first people's Hospital of Yunnan Province	23	27	4
The Second Affiliated Hospital of Zhejiang University	29	29	0
The Second Affiliated Hospital of Chongqing Medical University	68	76	8
Total	2898	3123	225

eTable 2. Demographics of Enrolled Subjects (N=2898)

Gender, No. (%)	Female	1,133(39.1)
	Male	1,765(60.9)
Age (y)	Mean ±SD	49.76 ±15.49
	Med (P25-P75)	50(39-62)
	Med (Mix-Max)	50(5-93)
SB cleanliness, No. (%)	Good	638(22.0)
	Medium	1,584(54.7)
	Poor	676(23.3)
SB completion rate, No. (%)	No	319(11.01)
	Yes	2,579(88.99)
Stomach transit time (min)	Mean ±SD	53.13±58.85
	Med (P25-P75)	33.33(13.43-72.63)
	Med (Mix-Max)	33.33(0.22-827.75)
SB Transit Time (min)	Mean ±SD	299.89 ±128.41
	Med (P25-P75)	276.69(221.0-365.98)
	Med (Mix-Max)	276.69(9.82-934.68)
Capsule working time (min)	Mean ±SD	579.27 ±137.07
	Med (P25-P75)	600.0(475.53-668.08)
	Med (Mix-Max)	600.0(35.35-1,054.50)

eTable 3. Comparison of 17 Types of Findings by Conventional Reading (CR) and *SmartScan* Assisted Reading (SSAR)

Protruding Lesions	Venous structure
	Nodule
	Mass/Tumour
	Polyp(s)
Flat Lesions	Angioectasia
	Plaque(red)
	Plaque(white)
	Red spot
	Abnormal villi
Mucosa	Lymphangiectasia
	Erythematous
	Oedematous
Excavated Lesions	Erosion
	Ulcer
	Aphtha
Content	Blood
	Parasite

eTable 4. Sensitivity of Findings in Patients Conventional Reading (CR) and *SmartScan* Assisted Reading (SSAR) (N = 2898)

	CR % (95% CI)	SSAR % (95% CI)	P value
Sens	88.05 (86.67-89.30)	98.80 (98.27-99.17)	<0.001
Spec	100.00 (99.20-100.00)	100.00 (99.20-100.00)	1.000
+PV	100.00 (99.77-100.00)	100.00 (99.79-100.00)	1.000
-PV	67.29 (64.07-70.36)	95.33 (93.31-96.78)	<0.001

eTable 5. Missed Findings by Conventional Reading (CR) and *SmartScan* Assisted Reading (SSAR)

Findings		CR, No.	SSAR No.
Protruding Lesions	Venous structure	111	8
	Nodule	152	21
	Mass/tumour	34	7
	Polyp(s)	90	17
Flat Lesions	Angioectasia	25	4
	Plaque(red)	79	19
	Plaque(white)	158	30
	Red spot	89	12
	Abnormal villi	102	23
Mucosa	Lymphangiectasia	261	22
	Erythematous	92	21
	Oedematous	44	14
Excavated Lesions	Erosion	89	19
	Ulcer	45	19
	Aphtha	26	3
Content	Blood	47	8
	Parasite	10	3

eTable 6. Reading Time and Number of Images by Conventional Reading (CR) and *SmartScan* Assisted Reading (SSAR)

		CR	SSAR	P value	Difference between two readings
SBCE Reading time (min)	Mean (SD)	51.42(11.60)	5.37(1.51)		46.05(11.16)
	Med (IQR)	50 (43-58)	5 (4-6)	<0.001 [a]	45 (38-53)
	Med (range)	50 (30-130)	5 (3-12)		45 (25-123)
Number of SBCE Images	Mean (SD)	27,910.83(12,882.89)	779.17(337.18)		27,131.66(12,888.95)
	Med (IQR)	26,277 (19,218-35,673)	861 (502-1,044)	<0.001 [b]	25,495 (18,398-34,905)
	Med (range)	26,277 (860.0-81,907)	861 (101-1,554)		25,495 (350-81,789)

a Comparison of reading time between CR and SSAR, non-parametric paired Wilcoxon rank sum test： Z=46.629，P<0.001

b Comparison of the number of pictures between CR and SSAR, non-parametric paired Wilcoxon rank sum test： Z=46.625, P<0.001

eTable 7. Clinical Diagnosis Based on the Findings of Combined Agreed Comparator

		n	%
Overall diagnosis (n=2,898)	Abnormal	1647	56.83
	Normal	1251	43.17
Abnormal Diagnosis (%, cases/2,898)	Inflammation- all grades	905	31.23
	Bleeding	236	8.14
	Neoplasia	450	15.53
	Infection	77	2.66
	Vascular abnormalities	501	17.29
	Total	2,169	-

eTable 8. Different Studies of Artificial Intelligence Application in Capsule Endoscopy

		Present Study	Hou XH, et al.	Hiroaki S, et al.
Learning Model Type		CNN	CNN	CNN
Center Number (n)		51	77	3
Total Image (n)		295,314,067	113,426,569	48091
Total Patients (n)		5825	6970	385
Lesion types (n)		17	>10	5
Training Dataset				
	Images	148,357,922	158,235	30,584
	Patients	2927	1970	292
Evaluation Dataset				
	Images	146,956,145	113,268,334	17,507
	Patients	2898	5000	93
Reading Time in one case(min)				
	Conventional reading	51.42±11.60	96.6 ± 22.53	Unknown
	AI reading	5.37 ±1.51	5.9±2.23	Unknown
Reduced Images in one case(n)				
	Conventional reading	27,910.83±12,882.89	22,654	Unknown
	AI reading	779.17±337.18	578	Unknown
Sensitivity%,95% CI		98.80(98.27-99.17)	99.90 (99.74-99.97)	90.7 (90.0-91.4)
Specificity%,95% CI		100.0(99.20-100.00)	100(99.72-100.00)	79.8 (79.0-80.6)