Supplementary Figures

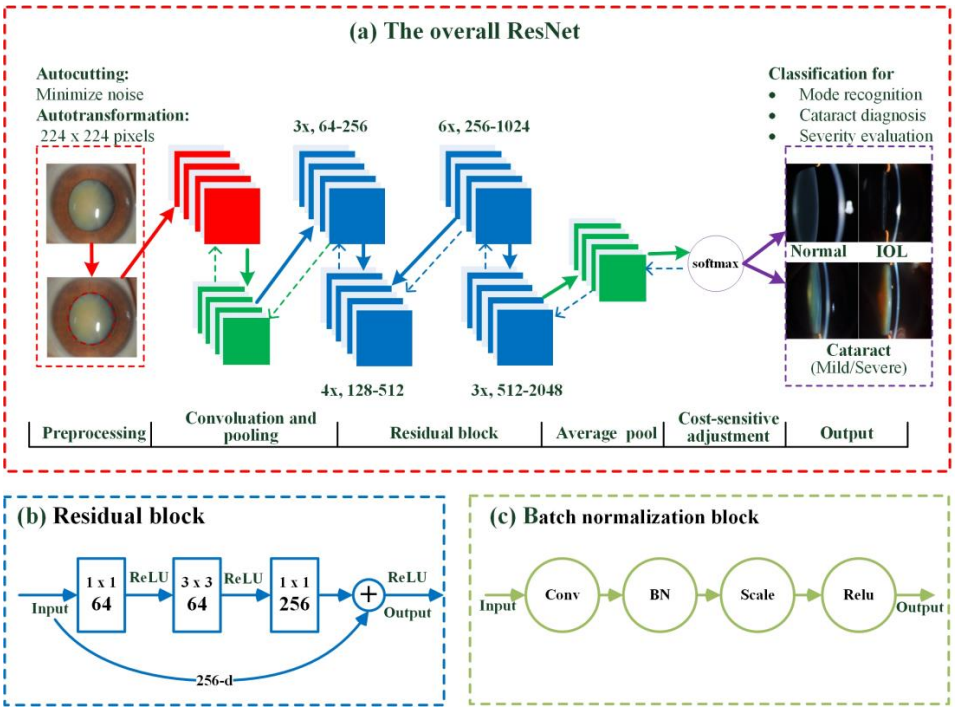

Figure S1. The architecture of the ResNet method. a, The overall architecture of the ResNet model; this model consists of convolution layers, a max-pooling operation and 16 residual blocks, which are indicated by the red, green and blue rectangles, respectively, followed by softmax and cost-sensitive adjustment layers. **b**, One unfolded residual block. **c**, The BN and scale operations. ResNet, residual network; BN, batch normalization; Conv, convolution operation; ReLU, rectified linear unit.

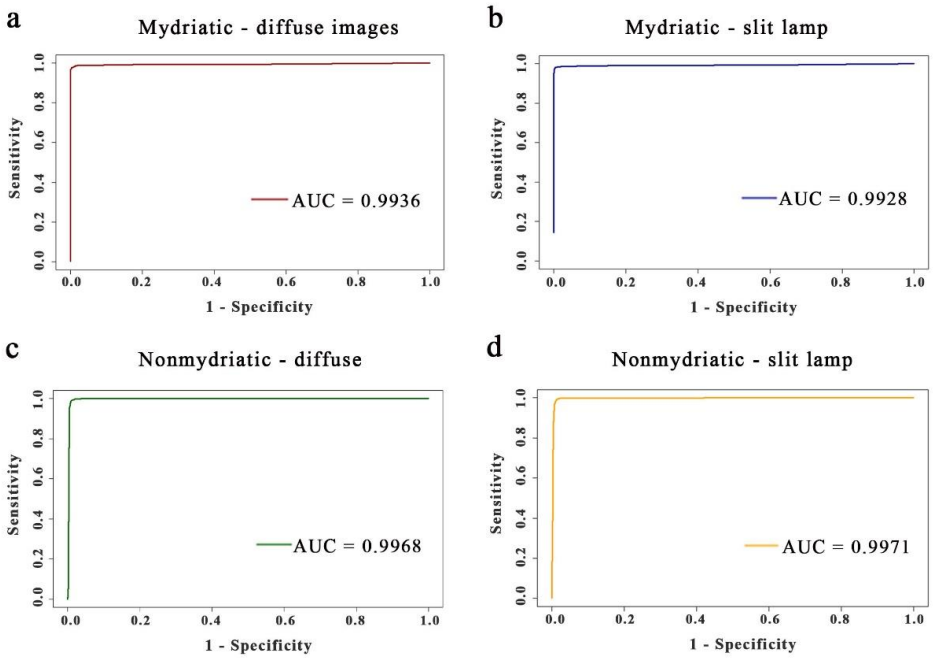

Figure S2. Receiver operating characteristic (ROC) curves and areas under the curve (AUCs) of the deep learning system for the detection of different capture modes. a, Mydriatic-diffuse images; **b,** mydriatic-slit lamp images; **c,** nonmydriatic-diffuse images; **d,** nonmydriatic slit lamp images.

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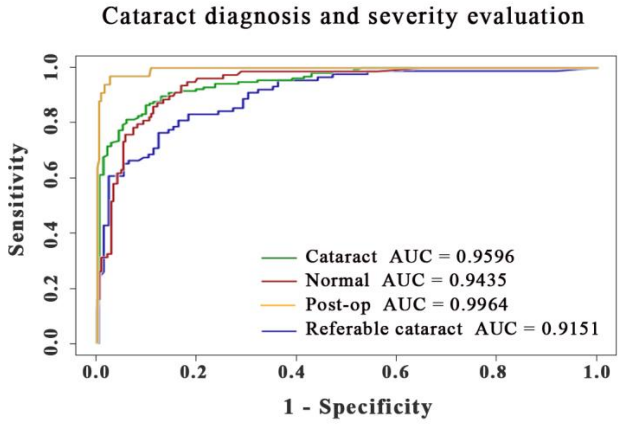

17 **Figure S3. Receiver operating characteristic (ROC) curves and areas under the**
18 **curve (AUCs) of diagnostic performance in the cataract AI ambulatory site in a**
19 **real-world tertiary referral pattern. a,** Mydriatic-diffuse images; **b,** mydriatic-slit
20 lamp images; **c,** nonmydriatic-diffuse images; **d,** nonmydriatic slit lamp images.

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Supplementary Tables

Table S1. Demographics and summary of the Chinese Medical Alliance for Artificial Intelligence (CMAAI) datasets.

Demographics	Training set number (%)	Validation set number (%)
Total number of images	30132	7506
Total number of eyes	23935	5036
Total number of patients	13036	3575
Age, adults (>18 years old)	27930 (92.7)	7475 (99.6)
Gender, Male	15110 (54.1)	4201 (56.2)
Datasets		
ZOCES 2013-2016	29002	1130
ZOCES 2016-2017	0	5999
HZSP	101	34
EGES	574	191
GHMEP	284	95
SCGSP	171	57
Capture modes		
Mydriatic & diffuse	7990 (26.5)	1991 (26.5)
Mydriatic & slit lamp	7990 (26.5)	1991 (26.5)
Nonmydriatic & diffuse	6162 (20.4)	1533 (20.4)
Nonmydriatic & slit lamp	7990 (26.5)	1991 (26.5)
Diagnosis		
Normal	3618 (12.0)	890 (11.9)
Mild cataract	7817 (25.9)	2606 (34.7)
Severe cataract	7233 (24.0)	2384 (31.8)
Postoperative eye	5363 (17.8)	1620 (21.6)

Footnotes: ZOCES: Zhongshan Ophthalmic Center Eye Study; HZSP: Huazhong Screening Program; EGES: Eastern Guangdong Eye Study; GHMEP: Guangdong-Hong Kong-Marco Greater Bay Area Eye Project; SCGSP: Southern China Guangming Screening Program.

Table S2. Compositions of the training and validation datasets considering the diseases and capture modes.

	Images (training/validation)	Mydriatic & diffuse	Mydriatic & slit lamp	Nonmydriatic & diffuse	Nonmydriatic & slit lamp
Total		7990/1991	7990/1991	6162/1533	7990/1991
Cataract diagnosis	**Normal**	661/200	352/60	771/200	1518/430
	Cataract	1830/451	1830/451	1830/451	1830/451
	Pediatric cataract				
	No VAO	1060/11	/	/	/
	VAO	1142/20	/	/	/
	Adult cataract				
	Mild (Nuclear I-II)	2456/600	2000/1000	1124/350	1540/300
	No PCO/ACO	/	3389/113	/	/
	PCO/ACO	/	2555/20	/	/
	Severe (Nuclear III-V)	2127/520	2000/1000	808/250	1167/250
	Post-op	2131/500	1752/800	645/200	939/120
	PCO				
	No VAO	5479/125	/	/	/
	VAO	4805/50	/	/	/

Footnotes: PCO: posterior capsular opacification; ACO: anterior capsular opacification; VAO: visual axis opacity.

Table S3. Diagnostic performance of the cataract AI agent.

		Index	Mydriatic & diffuse	Mydriatic & slit lamp	Nonmydriatic & diffuse	Nonmydriatic & slit lamp
Capture mode		**AUC**	99.36% (99.12%, 99.61%)	99.28% (99.01%, 99.54%)	99.68% (99.49%, 99.88%)	99.71% (99.55%, 99.88%)
		ACC	97.90% (97.54%, 98.21%)	97.90% (97.54%, 98.21%)	97.90% (97.54%, 98.21%)	97.90% (97.54%, 98.21%)
		SEN	97.74% (96.99%, 98.35%)	95.98% (95.02%, 96.80%)	98.63% (97.91%, 99.15%)	99.40% (98.95%, 99.69%)
		SPE	99.58% (99.37%, 99.74%)	99.89% (99.76%, 99.96%)	99.18% (98.92%, 99.39%)	98.55% (98.20%, 98.85%)
Cataract diagnosis	**Normal**	**AUC**	99.67% (99.04%, 100%)	99.82% (98.93%, 100%)	99.26% (98.16%, 100%)	99.30% (98.57%, 100%)
		ACC	98.79% (98.18%, 99.24%)	98.88% (98.42%, 99.23%)	96.00% (94.11%, 97.42%)	94.81% (92.99%, 96.26%)
		SEN	93.00% (88.53%, 96.12%)	93.33% (83.80%, 98.15%)	88.00% 81.70%, 92.73%	95.14% 92.34%, 97.15%
		SPE	99.51% (99.03%, 99.79%)	99.00% (98.56%, 99.33%)	98.67% (97.12%, 99.51%)	94.52% (91.90%, 96.50%)
	Cataract	**AUC**	99.93% (99.81%, 100%)	99.96% (99.90%, 100%)	99.19% (98.29%, 100%)	99.38% (98.72%, 100%)
		ACC	98.68% (98.04%, 99.15%)	98.92% (98.46%, 99.26%)	94.33% (92.17%, 96.04%)	94.55% (92.70%, 96.04%)
		SEN	98.57% (97.69%, 99.18%)	98.85% (98.28%, 99.27%)	96.33% (93.53%, 98.16%)	93.14% (89.97%, 95.56%)
		SPE	98.86% (97.76%, 99.51%)	99.07% (98.18%, 99.60%)	92.33% (88.72%, 95.08%)	95.71% (93.31%, 97.44%)
	Post-op	**AUC**	99.93% (99.74%, 100%)	99.93% (99.78%, 100%)	98.99% (97.66%, 100%)	99.74% (98.69%, 100%)
		ACC	98.46% (97.78%, 98.98%)	99.41% (99.05%, 99.65%)	95.33% (93.33%, 96.88%)	99.22% (98.31%, 99.71%)
		SEN	98.60% (97.14%, 99.44%)	98.38% (97.24%, 99.13%)	90.67% (84.84%, 94.80%)	95.71% (87.98%, 99.11%)
		SPE	98.41% (97.58%, 99.01%)	99.81% (99.50%, 99.95%)	96.89% (94.84%, 98.29%)	99.57% (98.75%, 99.91%)

Footnotes: AUC: area under the receiver operating curve; accuracy (ACC) = (TP + TN) / (TP + TN + FP + FN); sensitivity (SEN) = TP / (TP + FN); specificity (SPE) = TN / (TN + FP); TP = true positive; TN = true negative; FP = false positive; FN = false negative.

Table S4. Performance of the cataract AI agent for referable conditions regarding disease severity and etiology.

			AUC	ACC	SEN	SPE
Pediatric cataract	**VAO**		100.00% (100.00%, 100.00%)	100.00% (88.78%, 100.00%)	100.00% (83.16%, 100%)	100.00% (71.51%, 100.00%)
	No VAO		100.00% (100.00%, 100.00%)	100.00% (88.78%, 100.00%)	100.00% (71.51%, 100.00%)	100.00% (83.16%, 100.00%)
Adult cataract	**Nuclear (III-V)**	**MD**	98.84% (98.05%, 99.63%)	95.63% (94.26%, 96.75%)	94.04% (91.64%, 95.91%)	97.00% (95.30%, 98.21%)
		MS	99.15% (98.68%, 99.63%)	95.05% (94.01%, 95.96%)	94.80% (93.24%, 96.09%)	95.30% (93.80%, 96.53%)
		ND	93.28% (89.02%, 97.54%)	89.00% (84.90%, 92.31%)	88.67% (82.48%, 93.26%)	89.33% (83.26%, 93.78%)
		NS	98.38% (96.52%, 100%)	94.57% (91.65%, 96.70%)	94.00% (88.92%, 97.22%)	95.00% (91.00%, 97.58%)
	Nuclear (I-II)	**MD**	98.84% (98.01%, 99.66%)	95.63% (94.26%, 96.75%)	97.00% (95.30%, 98.21%)	94.04% (91.64%, 95.91%)
		MS	99.15% (98.67%, 99.63%)	95.05% (94.01%, 95.96%)	95.30% (93.80%, 96.53%)	94.80% (93.24%, 96.09%)
		ND	93.28% (88.96%, 97.60%)	89.00% (84.90%, 92.31%)	89.33% (83.26%, 93.78%)	88.67% (82.48%, 93.26%)
		NS	98.38% (96.73%, 100%)	94.57% (91.65%, 96.70%)	95.00% (91.00%, 97.58%)	94.00% (88.92%, 97.22%)
	No PCO/ACO		94.88% (90.52%, 99.24%)	88.00% (82.24%, 92.42%)	95.20% (89.85%, 98.22%)	70.00% (55.39%, 82.14%)
	PCO/ACO		94.88% (90.52%, 99.24%)	88.00% (82.24%, 92.42%)	70.00% (55.39%, 82.14%)	95.20% (89.85%, 98.22%)
Post-op PCO	**VAO**		91.90% (83.48%, 100.00%)	89.47% (82.97%, 94.12%)	70.00% (45.72%, 88.11%)	92.92% (86.53%, 96.89%)
	No VAO		91.90% (83.48%, 100.00%)	89.47% (82.97%, 94.12%)	92.92% (86.53%, 96.89%)	70.00% (45.72%, 88.11%)

Footnotes: AUC: area under the receiver operating curve; accuracy (ACC) = (TP + TN) / (TP + TN + FP + FN); sensitivity (SEN) = TP / (TP + FN); specificity (SPE) = TN / (TN + FP); TP = true positive; TN = true negative; FP = false positive; FN = false negative; VAO: visual axis opacity; PCO: posterior capsular opacification; ACO: anterior capsular opacification; MD: mydriatic-diffuse; MS: mydriatic-slit lamp; ND: nonmydriatic-diffuse; NS: nonmydriatic-slit lamp.