Appendix

Category Standardization: As shown in Table A, there exists variation in annotation granularity and operation tools across various cataract surgery datasets. Consequently, to ensure a fair evaluation of semantic segmentation, annotation aggregation is carried out to achieve category standardization, as depicted in Fig. A. Specifically, the most common objects in cataract surgery, including Iris, Pupil, Cornea, Skin, and Eye Retractors, are maintained as individual categories. The Surgical Tape category in CaDIS is consolidated into the Skin category, while the Intraocular Lens category in Cataract-1K is merged into the Pupil category. The diverse Operation Tools categories across datasets are combined into a single category. The miscellaneous category of Hand is removed from the evaluation.

Moreover, in the additional Cataract-1K dataset, Skin, Cornea, and Eye Retractors have not been annotated. As a result, the evaluation only includes Iris, Pupil, and Operation Tools.

TABLE A

AVERAGE PIXEL COVERAGE AND ATTENDANCE FRAMES FOR EACH ANNOTATION CATEGORY ACROSS VARIOUS CATARACT SURGERY DATASETS.

Standardized category	Class Name	CaDIS		CatInstSeg		CatS		Cataract-1K	
		Pixel(Rate)	Frame(Rate)	Pixel(Rate)	Frame(Rate)	Pixel(Rate)	Frame(Rate)	Pixel	Frame(Rate)
Iris	Iris	32748(11.2%)	4667(99.9%)	39088(13.4%)	281(100.0%)	36918(12.7%)	403(100.0%)	18340(6.3%)	2256(100.0%)
Pupil	Pupil	48989(16.8%)	4664(99.9%)	43199(14.8%)	281(100.0%)	44454(15.2%)	403(100.0%)	18119(6.2%)	2256(100.0%)
	Intraocular Lens	-	-	-	-	-	-	3580(1.2%)	535(23.7%)
Cornea	Cornea	142681(48.9%)	4670(100.0%)	110662(37.9%)	281(100.0%)	157613(54.1%)	403(100.0%)	-	-
Skin	Skin	38971(13.4%)	4664(99.9%)	85611(29.4%)	281(100.0%)	45510(15.6%)	403(100.0%)	-	-
	Surgical Tape	17279(5.9%)	3597(77%)	-	-	-	-	-	-
Operation Tools	Hydrodissection Cannula	368(0.1%)	447(9.6%)	1761(0.6%)	104(37.0%)	-	-	428(0.1%)	426(18.9%)
	Hydrodissection Cannula Handle	3(0.1‰)	12(0.3%)	-	-	-	-	-	-
	Rycroft Cannula	189(0.1%)	439(9.4%)	-	-	-	-	-	-
	Rycroft Cannula Handle	107(3.7‰)	84(1.8%)	-	-	-	-	-	-
	Viscoelastic Cannula	261(0.1%)	587(12.6%)	-	-	-	-	-	-
	Charleux Cannula	12(0.4‰)	20(0.4%)	-	-	-	-	-	-
	Primary Knife	409(0.1%)	308(6.6%)	1810(0.6%)	38(13.5%)	138(4.7‰)	20(5.0%)	62(2.1‰)	22(1.0%)
	Primary Knife Handle	1(0.03‰)	3(0.1%)	-	-	-	-	-	-
	Secondary Knife	309(0.1%)	297(6.4%)	894(0.3%)	46(16.4%)	-	-	34(1.2‰)	28(1.2%)
	Secondary Knife Handle	160(0.1%)	133(2.9%)	-	-	-	-	-	-
	Capsulorhexis Forceps	206(0.1%)	129(2.8%)	-	-	-	-	308(0.1%)	108(4.8%)
	Capsulorhexis Cystotome	271(0.1%)	448(9.6%)	230(0.1%)	18(6.4%)	-	-	113(3.9‰)	85(3.8%)
	Capsulorhexis Cystotome Handle	50(1.7‰)	84(1.8%)	-	-	-	-	-	-
	Bonn Forceps	761(0.3%)	384(8.2%)	2089(0.7%)	67(23.8%)	971(0.3%)	45(11.2%)	64(2.2‰)	28(1.2%)
	Troutman Forceps	54(1.9‰)	20(0.4%)	-	-	-	-	-	-
	Phacoemulsifier Handpiece	538(0.2%)	459(9.8%)	675(0.2%)	10(3.6%)	2824(1.0%)	82(20.4%)	2061(0.7%)	545(24.2%)
	Phacoemulsifier Handpiece Handle	138(4.7‰)	71(1.5%)	-	-	-	-	-	-
	I/A Handpiece	1052(0.4%)	774(16.6%)	2111(0.7%)	38(13.5%)	-	-	2009(0.7%)	451(20%)
	I/A Handpiece Handle	155(0.1%)	100(2.1%)	-	-	-	-	-	-
	Lens Injector	948(0.3%)	403(8.6%)	457(0.2%)	7(2.5%)	1299(0.4%)	23(5.7%)	485(0.2%)	66(2.9%)
	Lens Injector Handle	85(2.9‰)	40(0.9%)	-	-	-	-	-	-
	Micromanipulator	576(0.2%)	621(13.3%)	-	-	934(0.3%)	113(28.0%)	978(0.3%)	716(31.7%)
	Cotton	40(1.4‰)	20(0.4%)	-	-	-	-	-	-
	Iris Hooks	69(2.4‰)	126(2.7%)	-	-	-	-	-	-
	Marker	143(4.9‰)	169(3.6%)	-	-	-	-	-	-
	Mendez Ring	128(4.4‰)	7(0.2%)	-	-	-	-	-	-
	Suture Needle	3(0.1‰)	32(0.7%)	-	-	-	-	-	-
	Vitrectomy Handpiece	30(1.0‰)	17(0.4%)	-	-	-	-	-	-
	Needle Holder	45(1.5‰)	12(0.3%)	-	-	-	-	-	-
Eye Retractors	Eye Retractors	1666(0.6%)	3434(73.5%)	3011(1.0%)	266(94.7%)	939(0.3%)	144(35.7%)	-	-
Removed category	Hand	2154(0.7%)	607(13.0%)	-	-	-	-	-	-

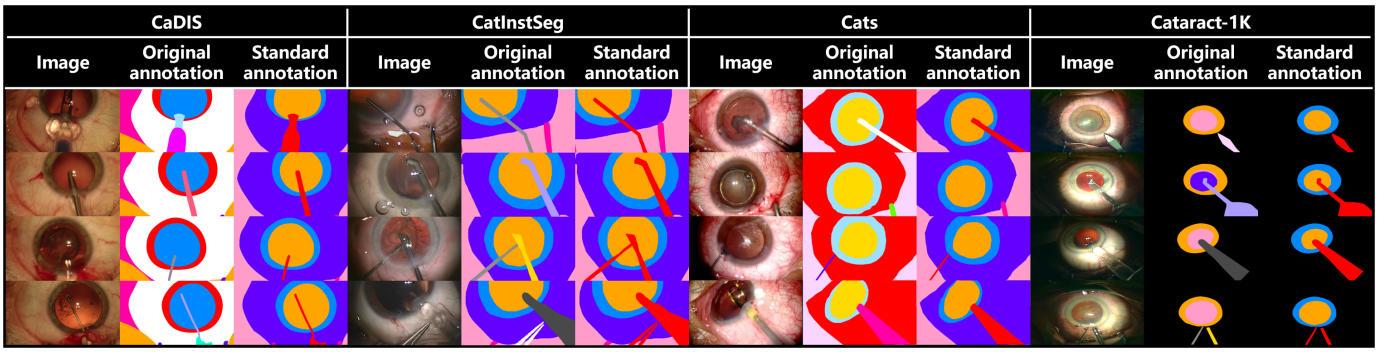

Fig. A. Category Standardization Exhibition. The original annotation categories from each dataset are standardized into unified categories.