Supplementary Material: Human-Aided Saliency Maps Improve Generalization of Deep Learning

Aidan Boyd, Kevin Bowyer, Adam Czajka
University of Notre Dame
Notre Dame, IN 46556
{aboyd3,kwb,aczajka}@nd.edu

A. Detailed Dataset Description

Table 1: Full dataset used for **training and validation** broken down by individual contributing dataset. The in-house currently unpublished data used in this work is denoted as *University of Notre Dame data*.

| Image Type	Contributing Dataset	# of Samples	Total Samples
Bona fide	ATVS-FIr [2]	800	**399,053**
	BERC_IRIS_FAKE [6]	2,776	
	CASIA-Iris-Thousand [1]	19,952	
	CASIA-Iris-Twins [1]	3,181	
	Disease-Iris v2.1 [7]	255	
	ETPAD v2 [5]	400	
	IIITD Contact Lens Iris [3]	13	
	IIITD Combined Spoofing Database [4]	4,531	
	LivDet-Iris Clarkson 2015 [11]	813	
	LivDet-Iris Warsaw 2015 [11]	36	
	LivDet-Iris Clarkson 2017 [10]	3,949	
	LivDet-Iris IIITD-WVU 2017 [10]	2,944	
	LivDet-Iris Warsaw 2017 [10]	5,167	
	University of Notre Dame data	354,236	
Textured contact lens	BERC_IRIS_FAKE [6]	140	**27,372**
	IIITD Contact Lens Iris [3]	3,420	
	LivDet-Iris Clarkson 2015 [11]	1,107	
	LivDet-Iris Clarkson 2017 [10]	1,881	
	LivDet-Iris IIITD-WVU 2017 [10]	1,700	
	University of Notre Dame data	19,124	
Paper printouts	ATVS-FIr [2]	800	**16,393**
	BERC_IRIS_FAKE [6]	1,600	
	IIITD Combined Spoofing Database [4]	1,371	
	LivDet-Iris Clarkson 2015 [11]	1,745	
	LivDet-Iris Warsaw 2015 [11]	20	
	LivDet-Iris Clarkson 2017 [10]	2,250	
	LivDet-Iris IIITD-WVU 2017 [10]	1,766	
	LivDet-Iris Warsaw 2017 [10]	6,841	
Post-mortem Irises	Post-Mortem-Iris v3.0 [8]	2,259	**2,259**
Synthetic	CASIA-Iris-Syn V4 [9]	10,000	**10,000**
Artificial	BERC_IRIS_FAKE [6]	80	**277**
	University of Notre Dame data	197	
Diseased irises	Disease-Iris v2.1 [7]	1,537	**1,537**
Textured contacts & printed	LivDet-Iris IIITD-WVU 2017 [10]	1,899	**1,899**

B. Annotation Tool
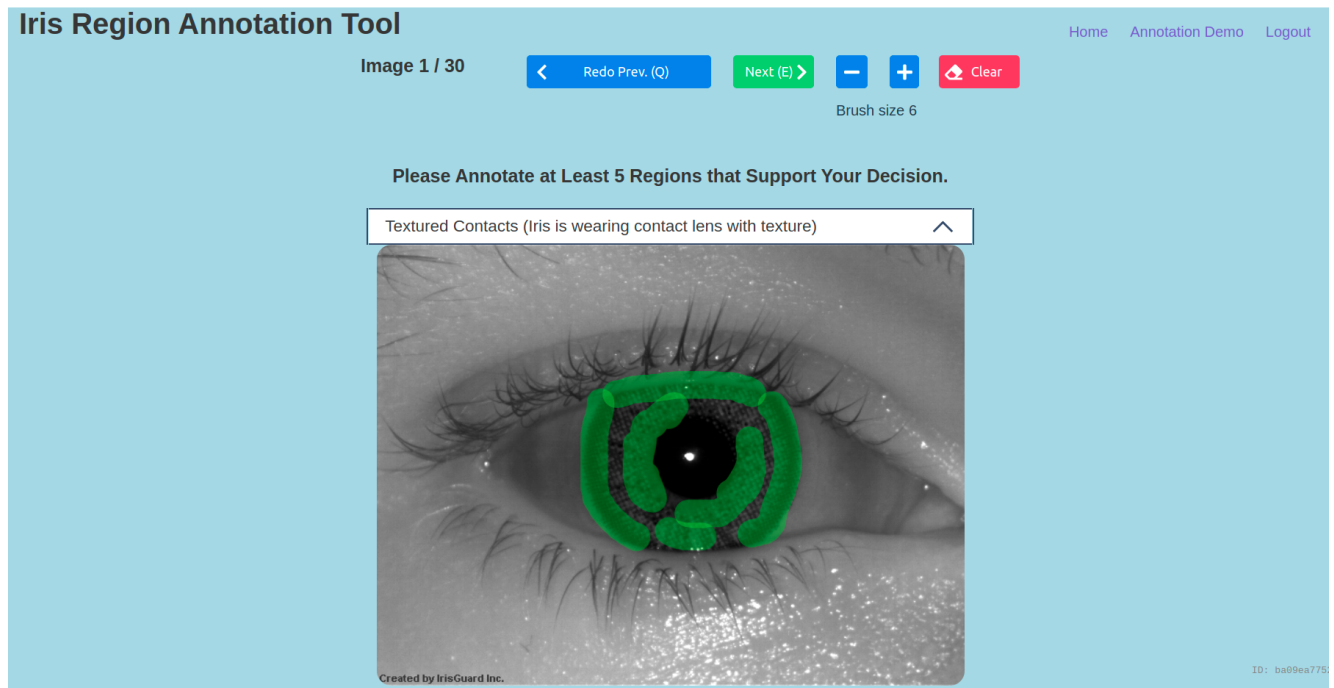
Figure 1: Online annotation tool developed to collect annotation data with an example input of a human solving the iris presentation attack detection task for a textured contact lens sample.

References

[1] Chinese academy of sciences institute of automation. http://www.cbsr.ia.ac.cn/china/Iris%20Databases%20CH.asp. Accessed: 03-12-2021. 1

[2] Javier Galbally, Jaime Ortiz-Lopez, Julian Fierrez, and Javier Ortega-Garcia. Iris liveness detection based on quality related features. In *2012 5th IAPR Int. Conf. on Biometrics (ICB)*, pages 271–276, New Delhi, India, March 2012. IEEE. 1

[3] Naman Kohli, Daksha Yadav, Mayank Vatsa, and Richa Singh. Revisiting iris recognition with color cosmetic contact lenses. In *IEEE Int. Conf. on Biometrics (ICB)*, pages 1–7, Madrid, Spain, June 2013. IEEE. 1

[4] Naman Kohli, Daksha Yadav, Mayank Vatsa, Richa Singh, and Afzel Noore. Detecting medley of iris spoofing attacks using desist. In *IEEE Int. Conf. on Biometrics: Theory Applications and Systems (BTAS)*, pages 1–6, Niagara Falls, NY, USA, Sept 2016. IEEE. 1

[5] Oleg Komogortsev. Eye Tracker Print-Attack Database (ETPAD) v2, 2014. 1

[6] Sung Joo Lee, Kang Ryoung Park, Youn Joo Lee, Kwanghyuk Bae, and Jai Hie Kim. Multifeature-based fake iris detection method. *Optical Engineering*, 46(12):1 – 10, 2007. 1

[7] M. Trokielewicz, A. Czajka, and P. Maciejewicz. Assessment of iris recognition reliability for eyes affected by ocular pathologies. In *IEEE Int. Conf. on Biometrics: Theory Applications and Systems (BTAS)*, pages 1–6, 2015. 1

[8] Mateusz Trokielewicz, Adam Czajka, and Piotr Maciejewicz. Post-mortem iris recognition with deep-learning-based image segmentation. *Image and Vision Computing*, 94:103866, 2020. 1

[9] Zhuoshi Wei, Tieniu Tan, and Zhenan Sun. Synthesis of large realistic iris databases using patch-based sampling. In *Int. Conf. on Pattern Recognition (ICPR)*, pages 1–4, Tampa, FL, USA, Dec 2008. IEEE. 1

[10] David Yambay, Benedict Becker, Naman Kohli, Daksha Yadav, Adam Czajka, Kevin W. Bowyer, Stephanie Schuckers, Richa Singh, Mayank Vatsa, Afzel Noore, Diego Gragnaniello, C. Sansone, L. Verdoliva, Lingxiao He, Yiwei Ru, Haiqing Li, Nianfeng Liu, Zhenan Sun, and Tieniu Tan. LivDet Iris 2017 – Iris Liveness Detection Competition 2017. In *IEEE Int. Joint Conf. on Biometrics (IJCB)*, pages 1–6, Denver, CO, USA, 2017. IEEE. 1

[11] David Yambay, Brian Walczak, Stephanie Schuckers, and Adam Czajka. LivDet-Iris 2015 - Iris Liveness Detection Competition 2015. In *IEEE Int. Conf. on Identity, Security and Behavior Analysis (ISBA)*, pages 1–6, New Delhi, India, Feb 2017. IEEE. 1