Source-free Adaptive Gaze Estimation by Uncertainty Reduction

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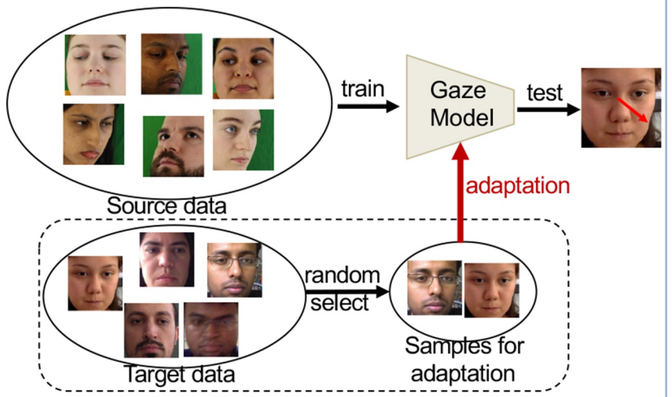
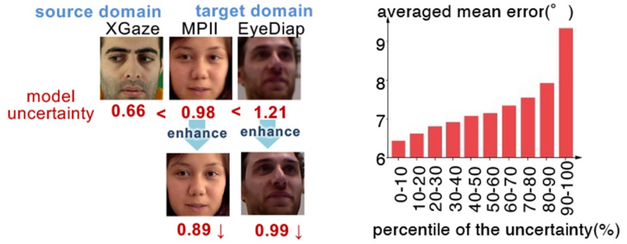
Introduction:

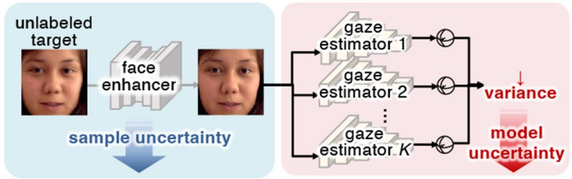
- **Goal**: Gaze model adaptation with unlabeled target data



- **Observation:** (a).the source-trained model shows high uncertainty on target domain (b). the cross-domain gaze error increases as the uncertainty grow

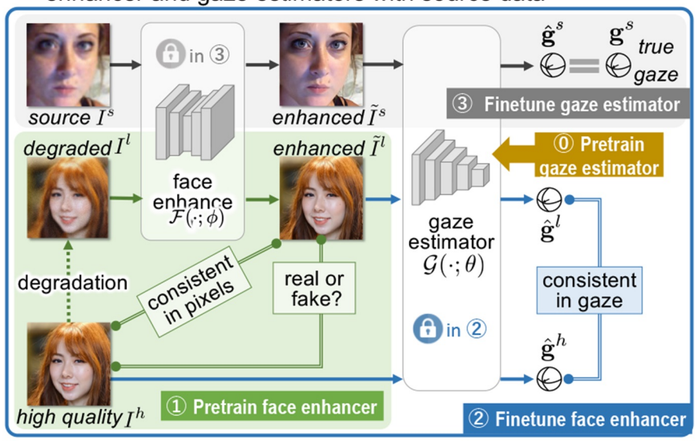


- **Main idea:** reduce both sample and model uncertainty



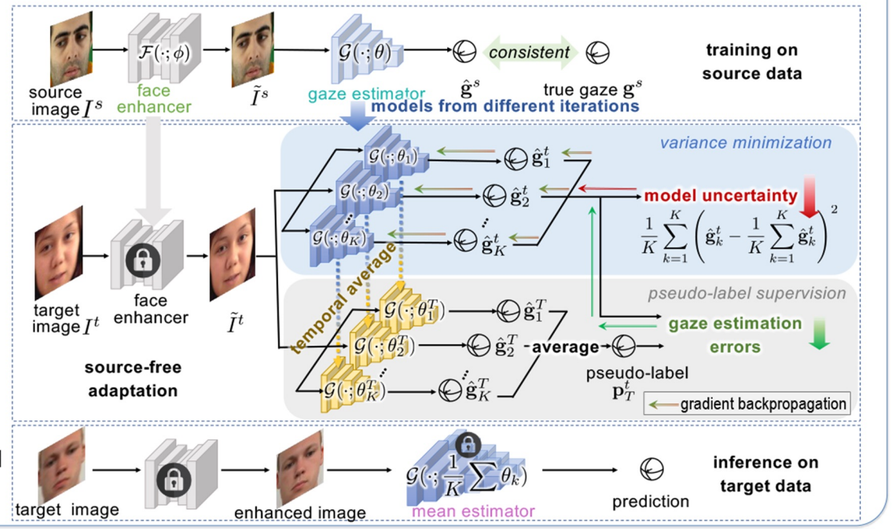
Method:

- collaboratively train a gaze-estimation-friendly face enhancer and gaze estimators with source data



Uncertainty Reduction Gaze Adaptation (UnReGA)

- training a face enhancer and gaze estimator on source data
- Unsupervised source-free adaptation with *variance minimization* and *pseudo-label supervision*
- Inference on target data with face enhancer and mean estimator



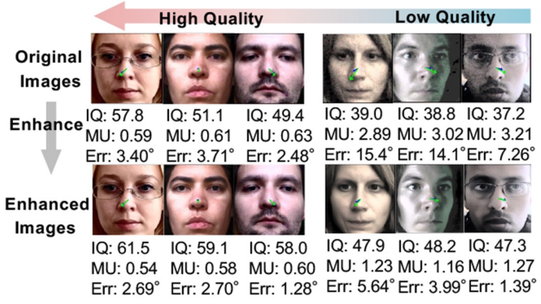
Experiments:

- UnReGA achieves best performance on cross-domain gaze estimations tasks.

Method	$\mathcal{D}_E \to \mathcal{D}_M$	$\mathcal{D}_E \to \mathcal{D}_D$	$\mathcal{D}_G \to \mathcal{D}_M$	$\mathcal{D}_G \to \mathcal{D}_D$
Only Source	7.50	7.88	7.23	8.02
w/o source				
PureGaze [2]	7.08	7.48	9.28	9.32
PnP-GA(oma) [4]	5.65	-	6.86	-
CSA [6]	5.37	6.77	7.30	7.73
RUDA [1]	5.70	6.29	6.20	5.86
w/ source				
Gaze360 [3]	5.97	7.84	7.38	9.61
GazeAdv [5]	6.75	8.10	8.19	12.27
PnP-GA [4]	5.53	5.87	6.18	7.92
CRGA [6]	5.68	5.72	6.09	6.68
UnReGA⁻	5.35	6.06	5.58	5.84
UnReGA	**5.11**	**5.70**	**5.42**	**5.80**

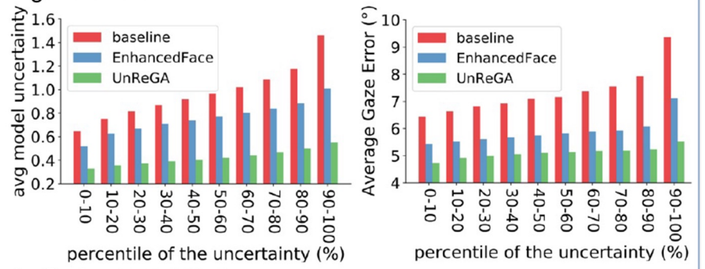
* UnReGA ⁻ denotes UnReGA without face enhancement

- Face examples for face enhancement with image quality (IQ), model uncertainty (MU) and gaze errors (Err).



* The blue and green arrows denote the gaze labels and the predictions respectively

- Correlation between reducing model uncertainty and reducing gaze errors



- Code:
- Reference:

[1]. Bao et al., CVPR 2022; [2]. Cheng et al., AAAI 2022; [3]. Kellnhofer, et al., CVPR 2019; [4]. Liu et al., ICCV 2021; [5].Wang et al., CVPR 2019; [6]. Wang et al., CVPR 2022;