Increasing the realism of synthetic images from the simulator using unmarked real data

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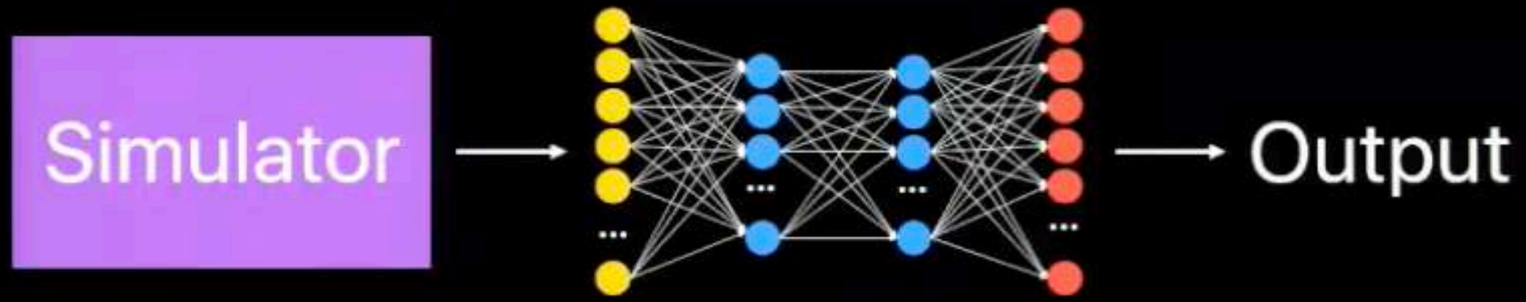
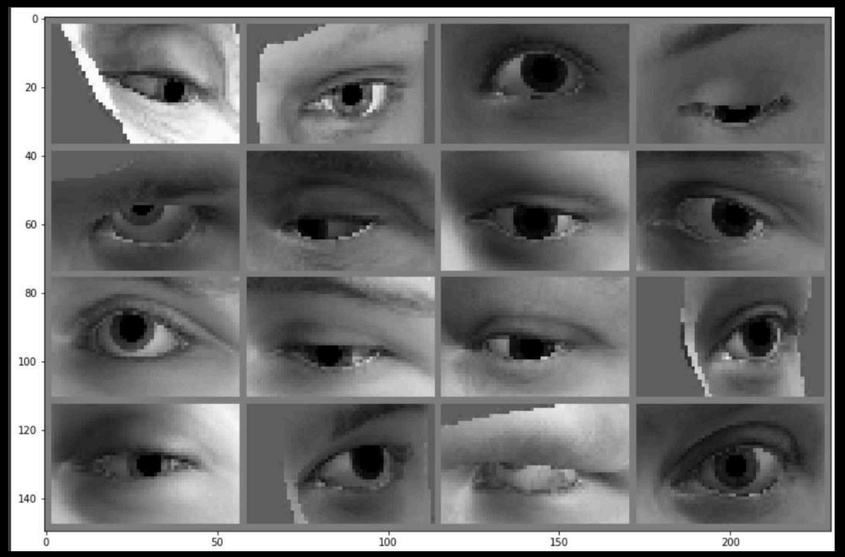
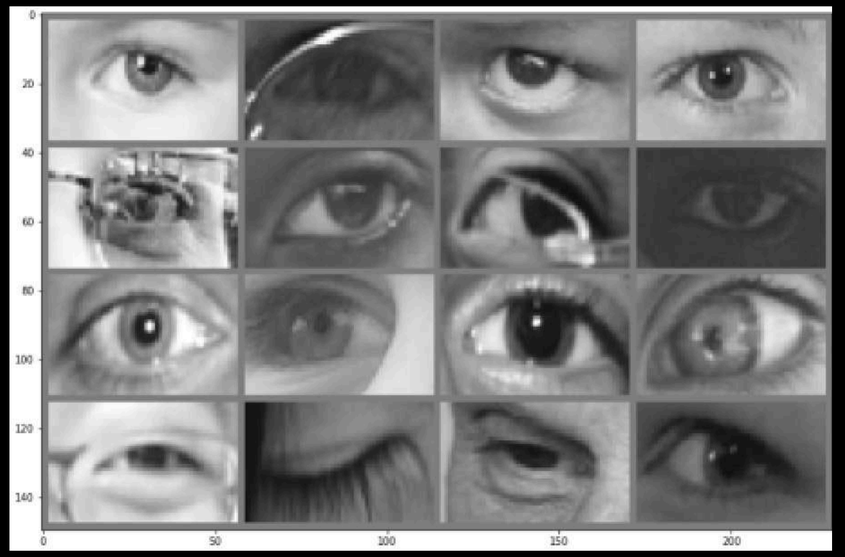
Motivation using synthetic data



Gap between real and synthetic images



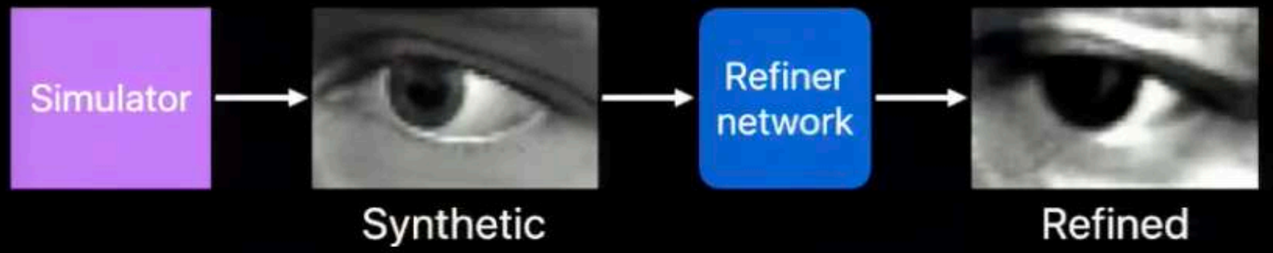
Synthetic images from Unity eye simulator



Real images

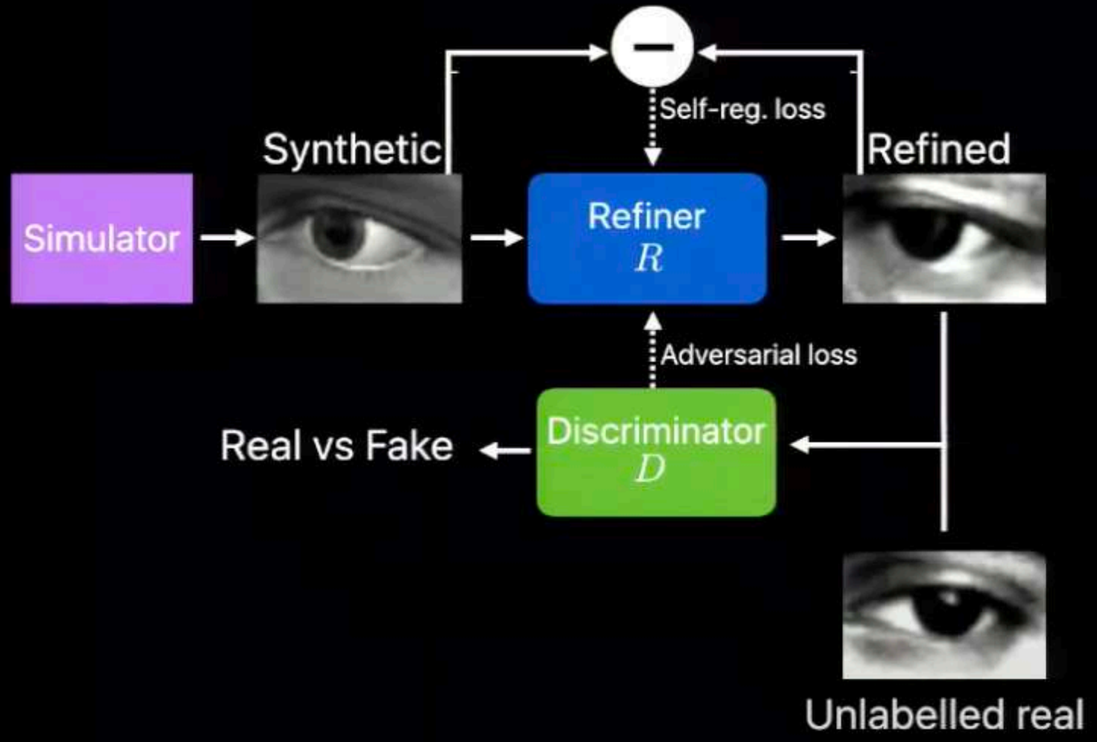
Add realism to synthetic data

- Real and refined images should look similar
- No unrealistic artefacts in refined images



https://arxiv.org/pdf/1612.07828.pdf

Sim GAN overview



Discriminator loss

$$\mathcal{L}_D^i(\phi) = \underbrace{-\log(1 - D(\mathbf{y}_i))}_{\text{Label 0 for real image}} \quad \underbrace{-\log(D(R(\mathbf{x}_i)))}_{\text{Label 1 for refined image}}$$

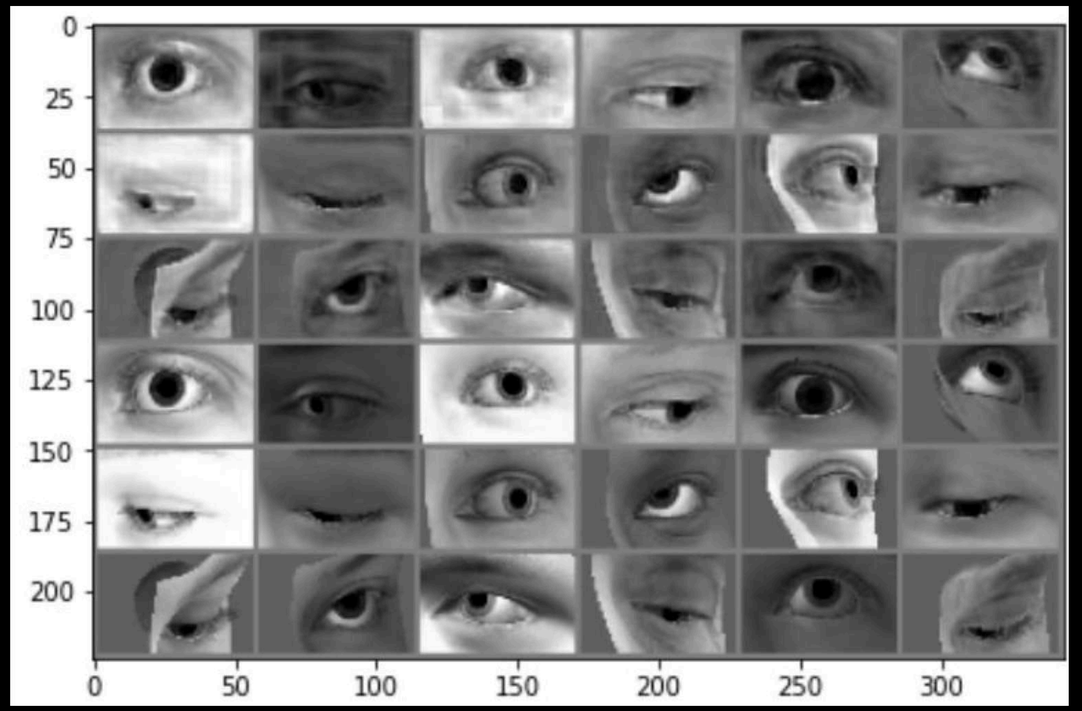
Refiner loss

$$\mathcal{L}_R^i(\theta) = \underbrace{-\log(1 - D(R(\mathbf{x}_i)))}_{\text{Label 0 for \textbf{refined} image}} \quad \underbrace{+\lambda \|R(\mathbf{x}_i) - \mathbf{x}_i\|_1}_{\text{Preserve annotation}}$$

(Makes refined look real)

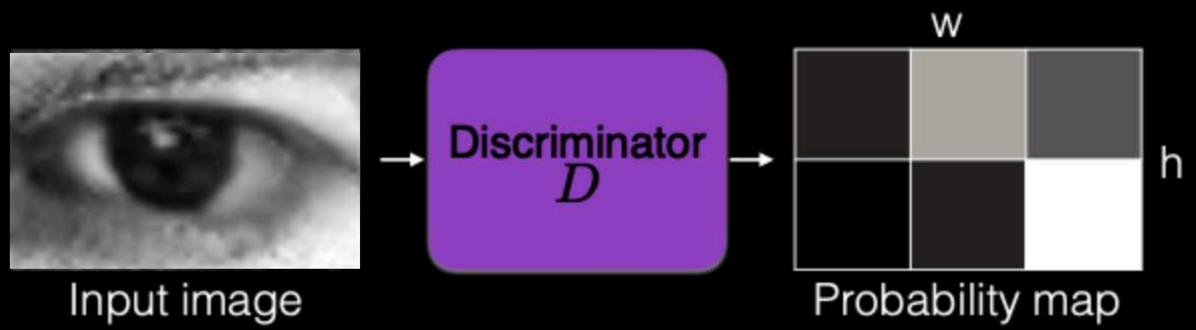
About data and interim results

Synth data: Eye Gaze dataset
Real data: Helen Eye Dataset

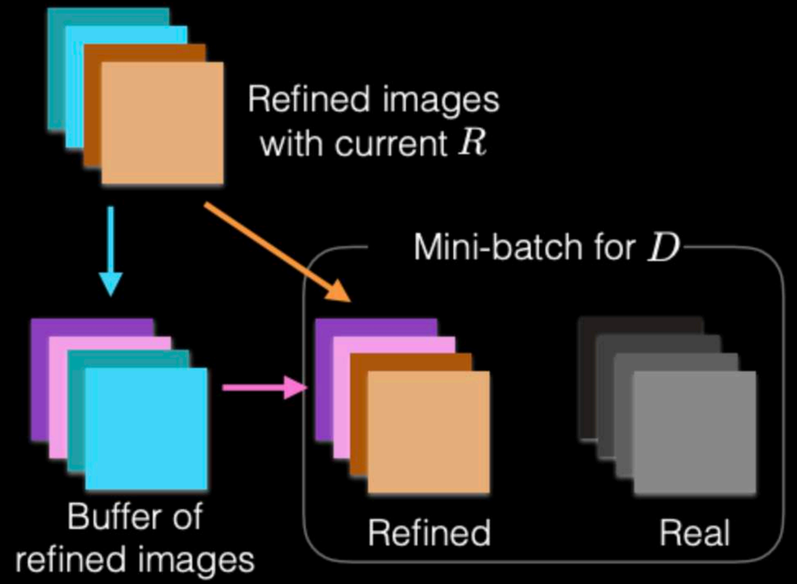


Model improvements

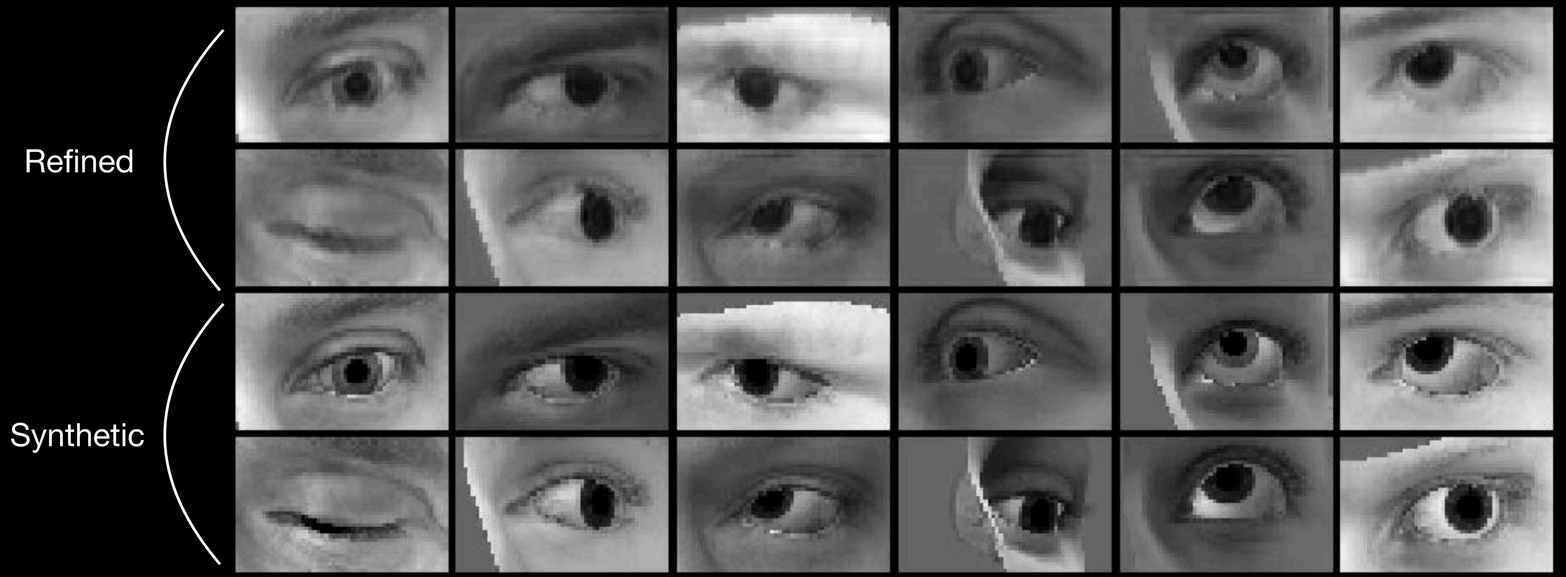
Probability map

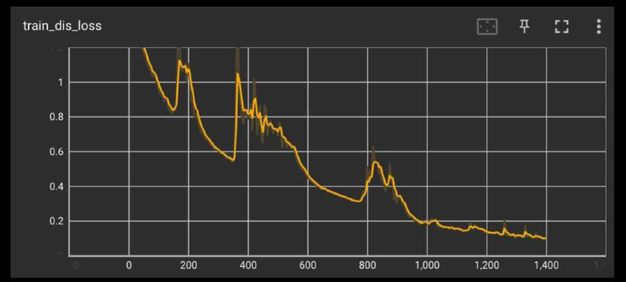


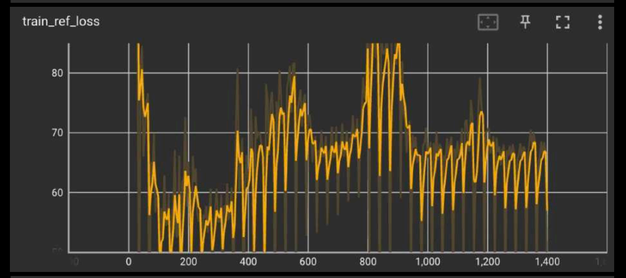
History of refined images

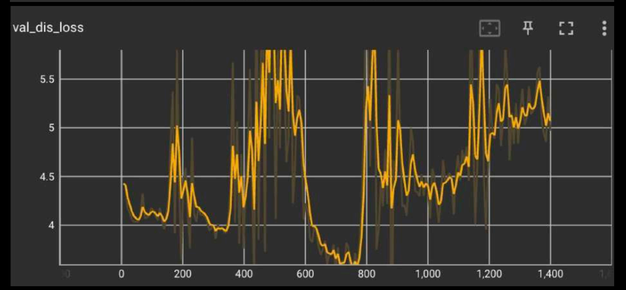


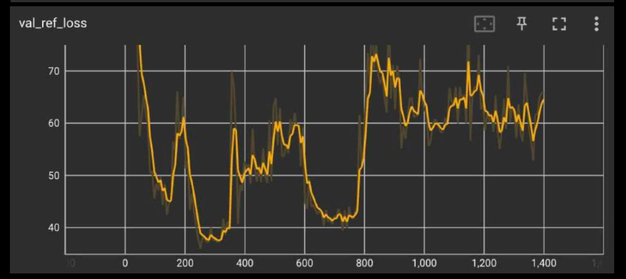
Results using improvements











Ideas for the future

- Try to use U-net as a discriminator
- Train on cleaner real data

Thank you for your attention