Photo-realism project pipeline:

Progetto  
Negli articoli che abbiamo trovato il miglioramento dei dati sintetici viene fatto allenando delle reti con dataset disaccoppiati (simgan cyclegan)  
Noi vogliamo vedere se usando una rete che accetta dati accoppiati, le immagini migliorano o meno (pix2pix)  
Un’ulteriore idea (futura) sarebbe poi quella di modificare la rete per sfruttare la segmentazione delle immagini

1. Preprocess the single datasets
2. Apply **Histogram Matching** to the synthetic GTA images before the retrieval process. It Adjusts the color distribution of synthetic images to match the real images, which can make them look more realistic. This helps in better feature extraction and matching since the color distributions will be closer to those of the real images.
3. Use a **Retrieval algorithm** to create a paired gta-to-cityscapes dataset with the closest images where the real one is taken from cityscapes and the synthetic one from gta.
4. We load the GTA and Cityscapes
5. We use a pretrained Dinov2-small (that want images in the resolution 224X224 and is more accurate than resnet18) to extract features and cosine similarity to select the best pairs
6. Preprocess the gta-to-cityscapes dataset
7. Apply **Bilateral Filtering** on the gta images of gta-to-cityscapes dataset to reduce noise and preserving the edges. It reduces artificial noise while preserving important details. This way, the synthetic images can better match the natural quality of the real Cityscapes images, which remain unaltered to ensure that they provide a true-to-life reference for the model.
8. Divide the paired dataset into train and test set (mantaining the correspondence of similarity)
9. Apply random **Perspective transformation** to a random portion of the images in the training paired dataset to create variations. The training loader applies these transformations on-the-fly to each batch, providing diverse samples for each epoch. It creates dataset augmentation, increasing dataset variability, improving model robustness to various viewing angles and positions, ensuring diverse representations and enhancing model generalization.
10. Save the paired dataset in the directory as the model requires: /dataset/combinedAB
11. Train a (pretrained) **GAN model (Pix2pix pretrained on day2night)** on the gta-to-cityscapes dataset.
12. Train and test pix2pix
13. Confront the results with the results of a **Pix2pix trained with a randomly paired dataset** and of a **CycleGAN** trained and tested on the unpaired original datasets