FACE AGING USING Cycle-GAN (Cycle-Generative adversarial networks)

A Deep Learning Approach to Age Progression

EAI 6020- FINAL PROJECT

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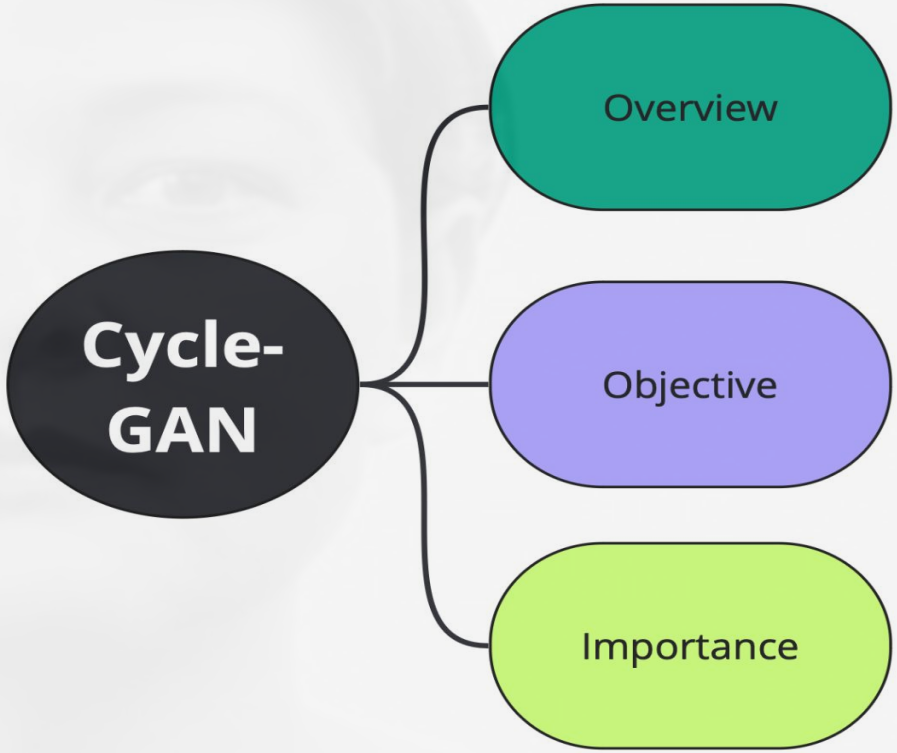
Introduction & Modelling

Age Estimation Tool for performance evaluation.

- Overview of the project: Proposed a **CycleGAN** based model for predictive aging.
- Objective: Generate predictive images of people's appearance after certain years based on their current images using CycleGAN
- Importance: No need for a paired dataset; Ensures original and translated images represent the same person. Enables domain knowledge transfer without paired examples.



Face Aging Using GANs - Why CycleGAN?

Benefits of CycleGAN for Face Aging

- **No Need for Paired Data:** Overcomes challenges of obtaining paired images of the same individual at different ages.
- **Cycle-Consistency Loss:** Ensures translated images maintain the identity of the original input.
- **Captures Subtle Facial Features:** Effective in learning and translating complex facial characteristics associated with aging.
- **Flexible Architecture:** Allows incorporation of transfer learning and fine-tuning for enhanced performance.

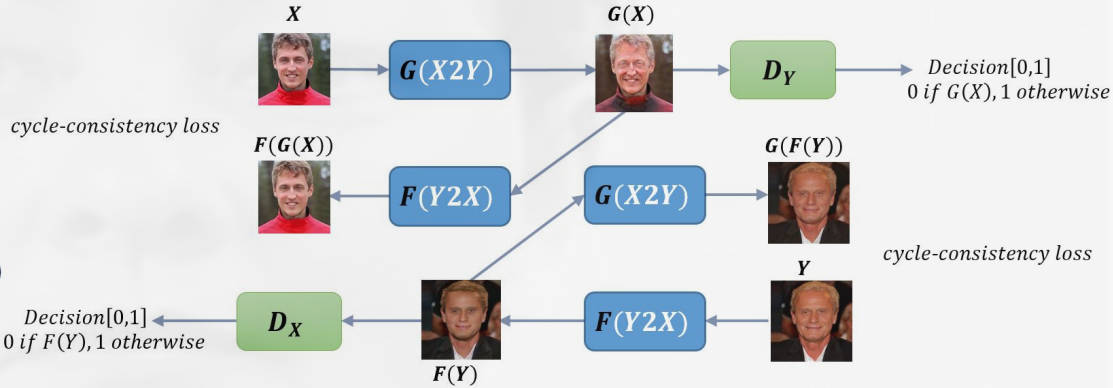


Fig: Cycle GAN Model Architecture

Source: GitHub

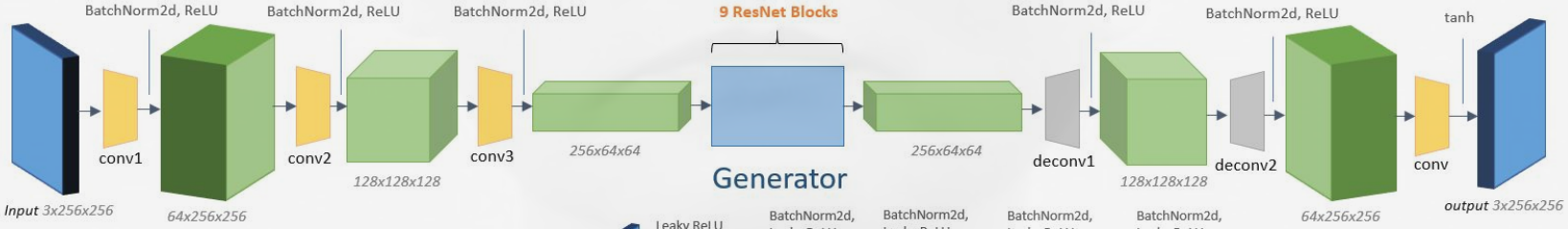
Generator-ResNetBlock-Discriminator

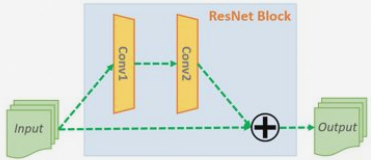
ResNetBlock:

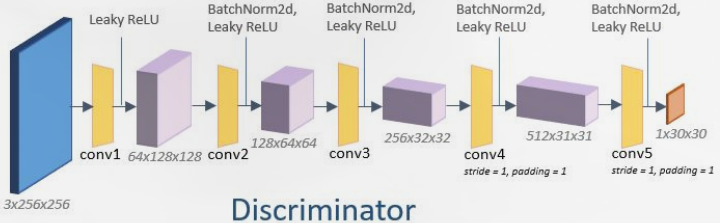
- Stands for "Residual Network Block".
- Helps in building deeper networks without facing the vanishing gradient problem.
- Contains skip connections that allow the gradient to flow more directly during backpropagation.
- Enhances the stability and speed of training, leading to better convergence.

Discriminator:

- Differentiates between real and translated/generated images.
- Enhances the quality of generated images by providing feedback to the generator.
- Utilizes adversarial loss to train the generator to produce more realistic images.
- Acts as a critical component in the adversarial training process of CycleGAN.





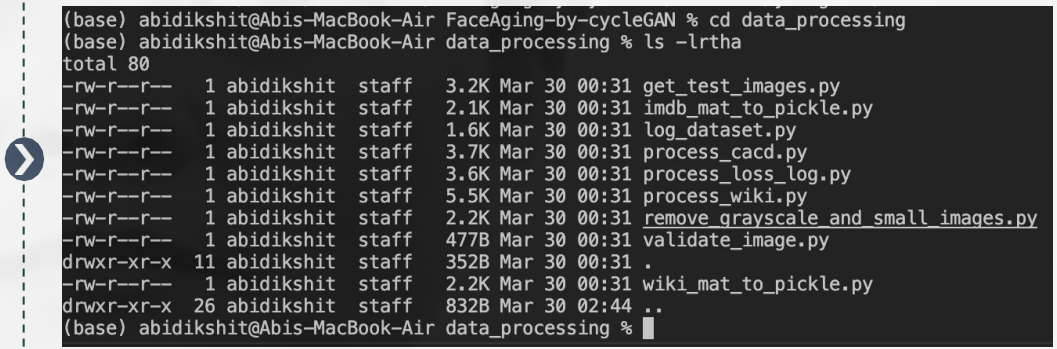


Source: GitHub

Dataset & Data Processing

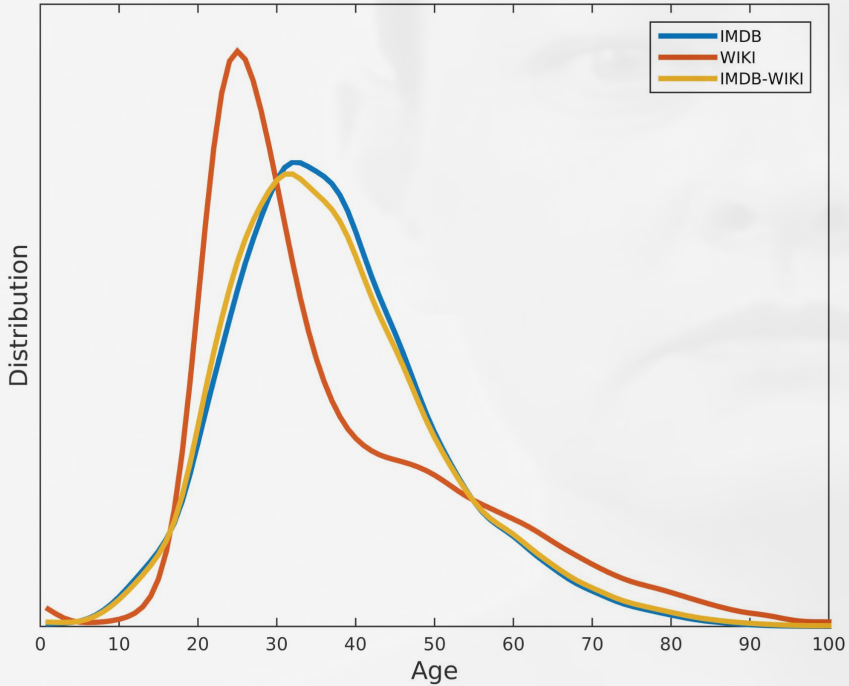
Contribution & Data Processing

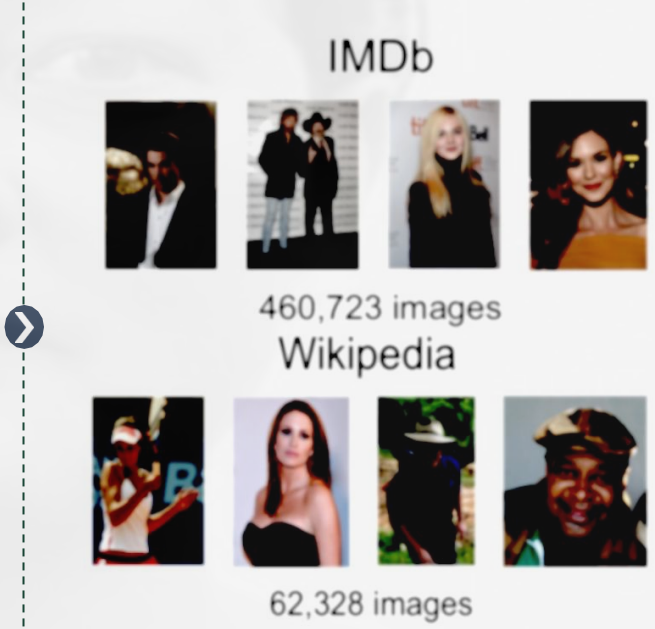
- Based on **Original CycleGAN implementation**.
- Extended functionalities to handle datasets and support transfer learning.
- Data processing utilities:
  - get_test_images.py
  - imdb_mat_to_pickle.py
  - wiki_mat_to_pickle.py
  - process_cacd.py
  - process_wiki.py
  - log_dataset.py
  - remove_grayscale_and_small_images.py
  - validate_image.py
  - process_loss_log.py

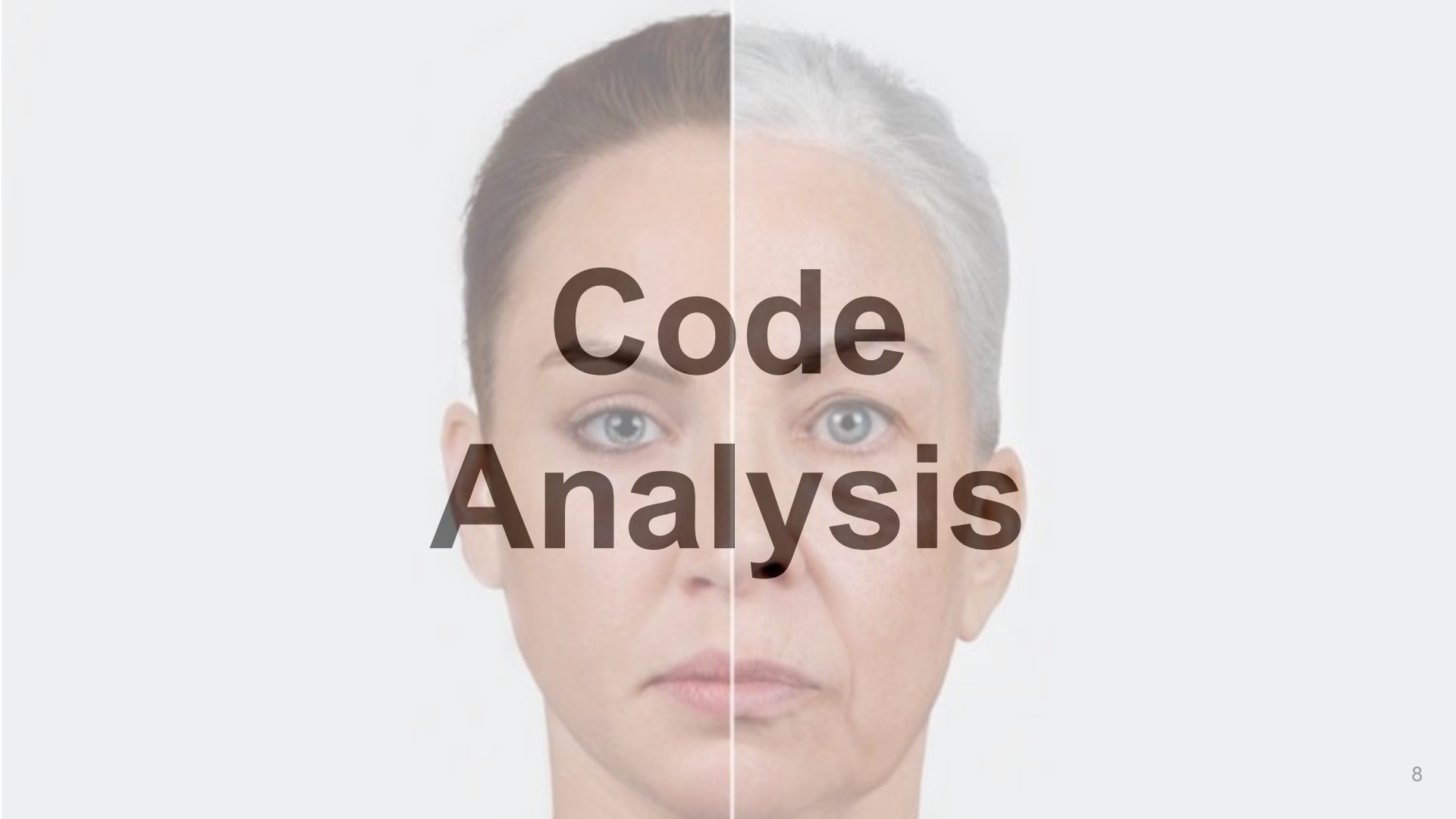


Dataset

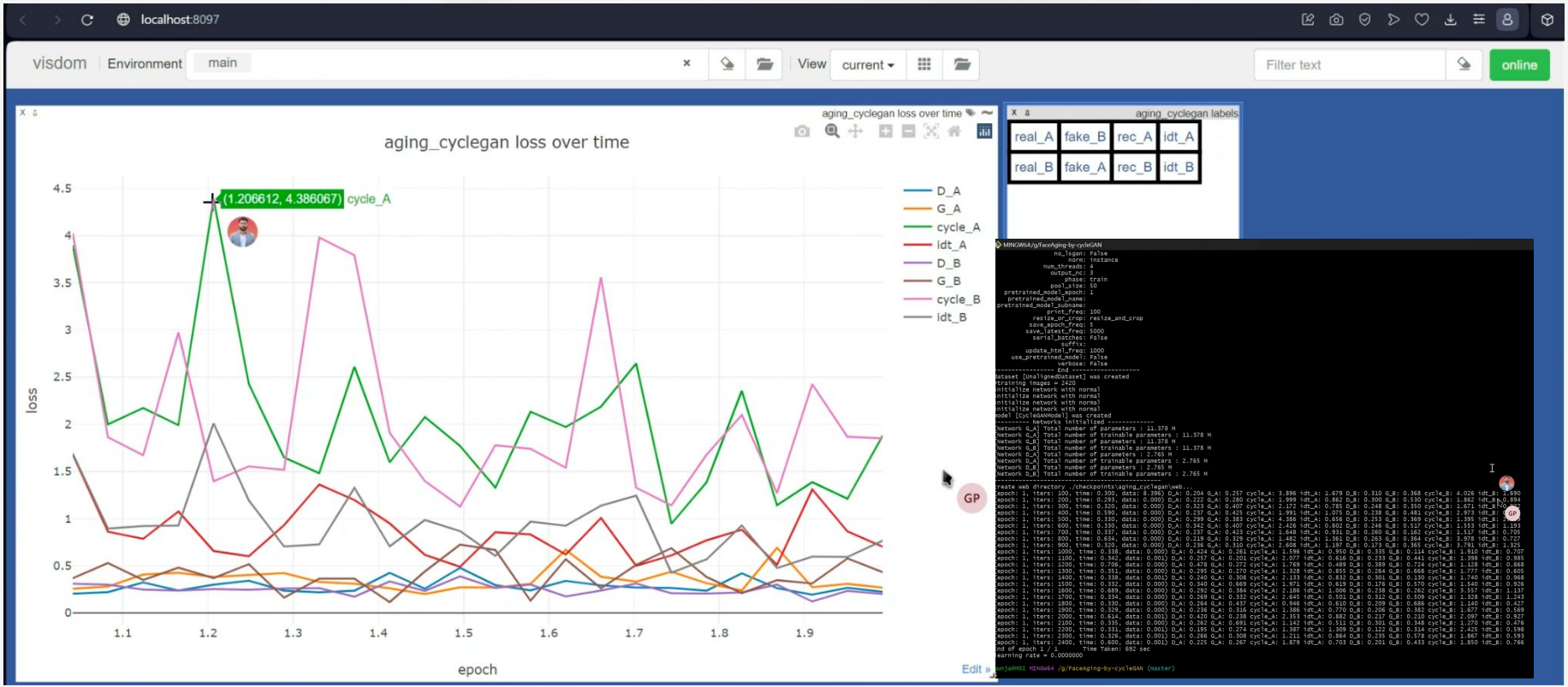
- **IMDB-WIKI-500k:** 500k+ celebrity face images with age and gender labels
- **Cross-Age Celebrity Dataset (CACD):** 163 k+ images of 2,000 celebrities



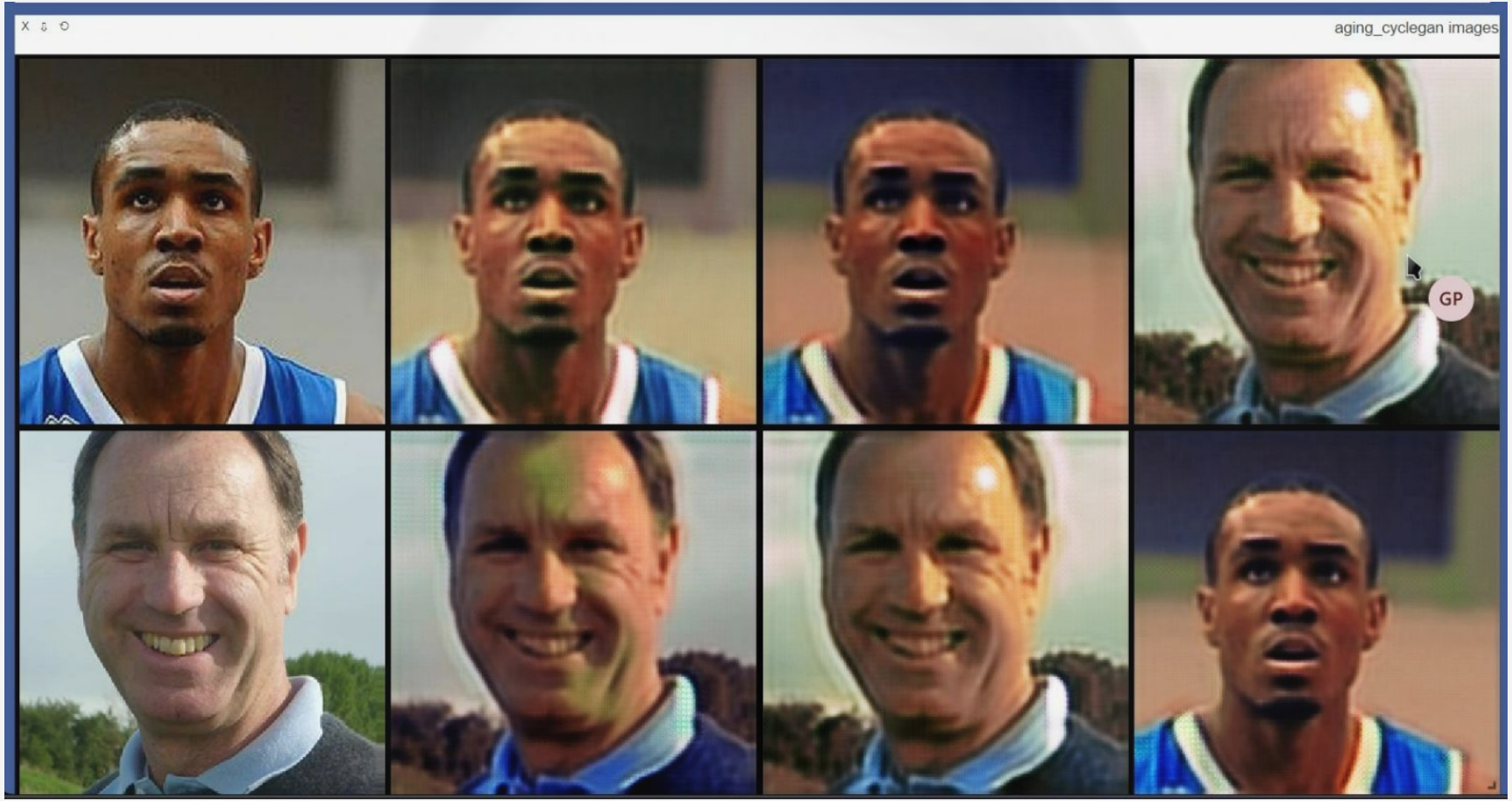



Code
Analysis

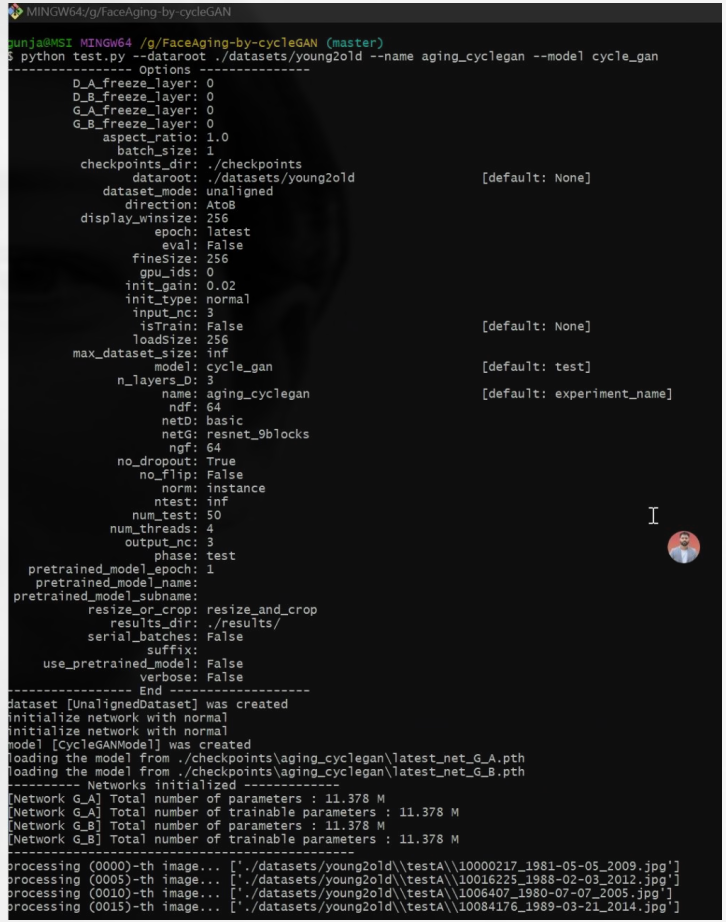
Model Training & Output



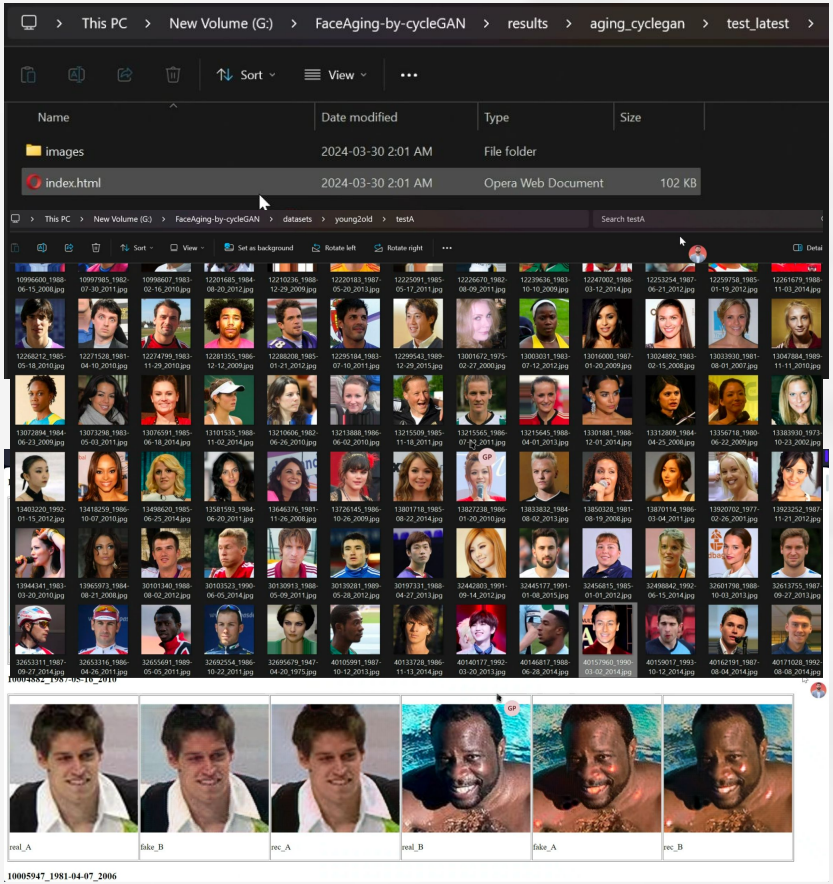
Training Output



Model Testing



Model Testing & Output



Result & Conclusion

Result & Conclusion

- **Model Comparison** and quantitative results.
- Visual representation of aging transformations.

#	Source	Mix	Epochs	Preloaded?	Freeze until	G Size	Max	Avg	10+	15+	20+
0	CACD	All	200	N/A	N/A	9 blocks	25.8	6.7	22%	5.5%	1.7%
1	WIKI	All	200	N/A	N/A	9 blocks	31.2	8.8	37%	14%	5.8%
2	WIKI	Female	200	N/A	N/A	9 blocks	19.5	4.6	7.1%	2.5%	0.0%
3	WIKI	Male	200	N/A	N/A	9 blocks	27.3	10.3	50%	19%	5.1%
4	WIKI	Male	200	N/A	N/A	6 blocks	N/A	N/A	N/A	N/A	N/A
5	WIKI	All	200	horse2zebra	8th block	9 blocks	27.4	11.0	55%	20%	6.3%
6	WIKI	All	200	summer2winter	8th block	9 blocks	25.0	8.9	36%	10%	1.7%
7	WIKI	All	200	monet2photo	8th block	9 blocks	20.1	6.6	15%	2.5%	0.4%
8	WIKI	Male	100	horse2zebra	N/A	9 blocks	25.8	9.9	46%	12%	1.3%
9	WIKI	Male	100	Model #2	N/A	9 blocks	32.8	10.3	51%	18%	6.0%

Source: GitHub

References

References

- Face aging with conditional generative adversarial networks. (2017, September 1). IEEE Conference Publication | IEEE Xplore. https://ieeexplore.ieee.org/document/8296650
- Ai, N. (2022, April 7). GAN for Face Aging problem | Neurond AI | Medium. Medium. https://neurondai.medium.com/what-does-your-face-look-like-in-the-next-few-years-gans-for-face-aging-problems-8568299adfd
- Wikipedia contributors. (2024, March 20). Generative adversarial network. Wikipedia. https://en.wikipedia.org/wiki/Generative_adversarial_network
- Jiechen. (n.d.). *GitHub - jiechen2358/FaceAging-by-cycleGAN*. GitHub. https://github.com/jiechen2358/FaceAging-by-cycleGAN/tree/master?tab=readme-ov-file


Any
Questions?