PHOTO/VIDEO EFFECT CREATION ON A PERSON USING CONVOLUTIONAL NEURAL NETWORKS

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Date: 23 May 2022

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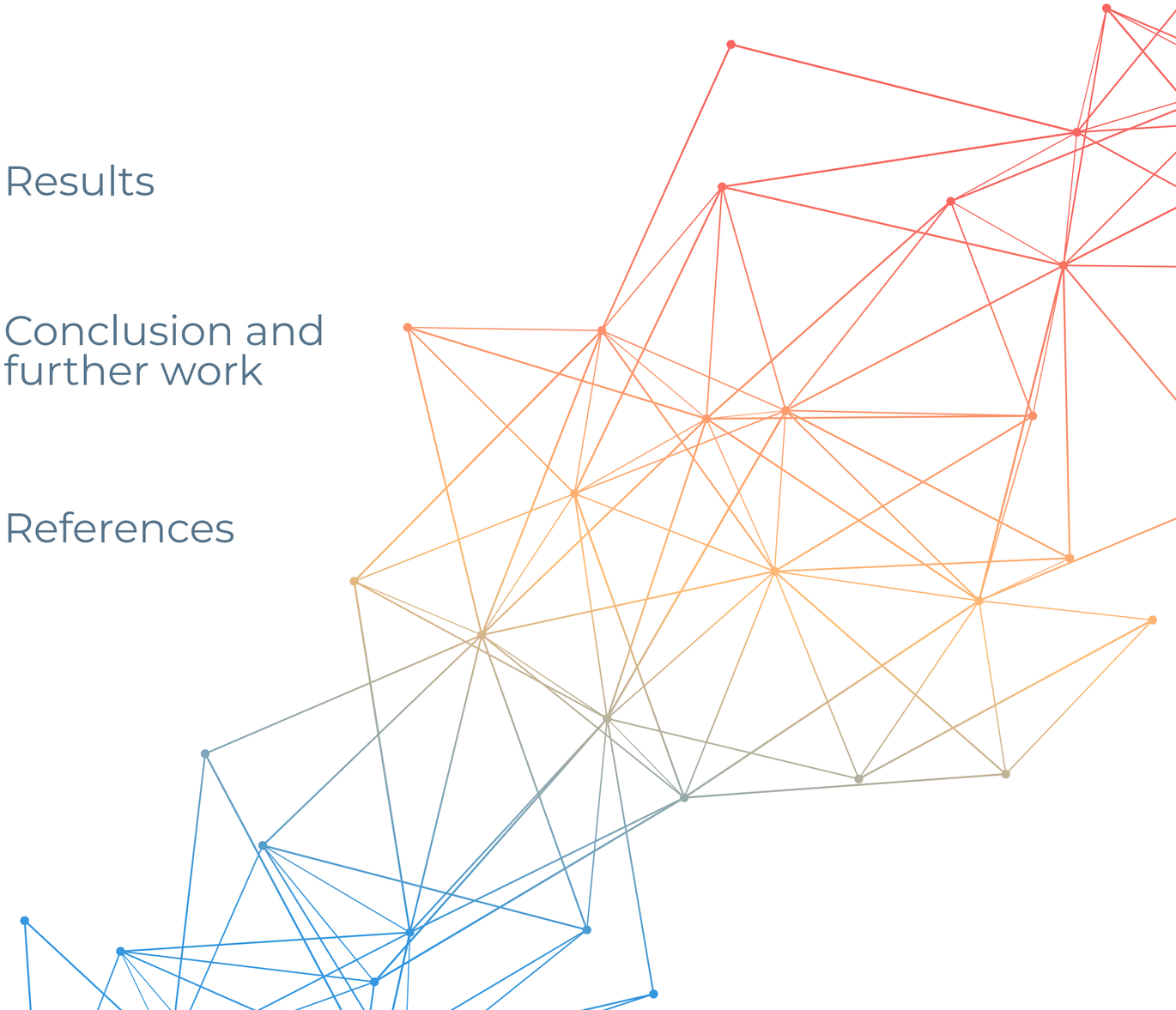


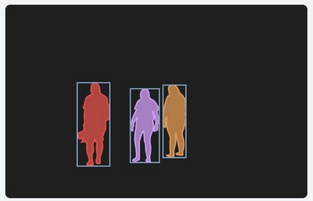
1. Introduction

1.1 Problem Definition

Create photo/video effects using person segmentation techniques

(a) Image

(b) Semantic Segmentation

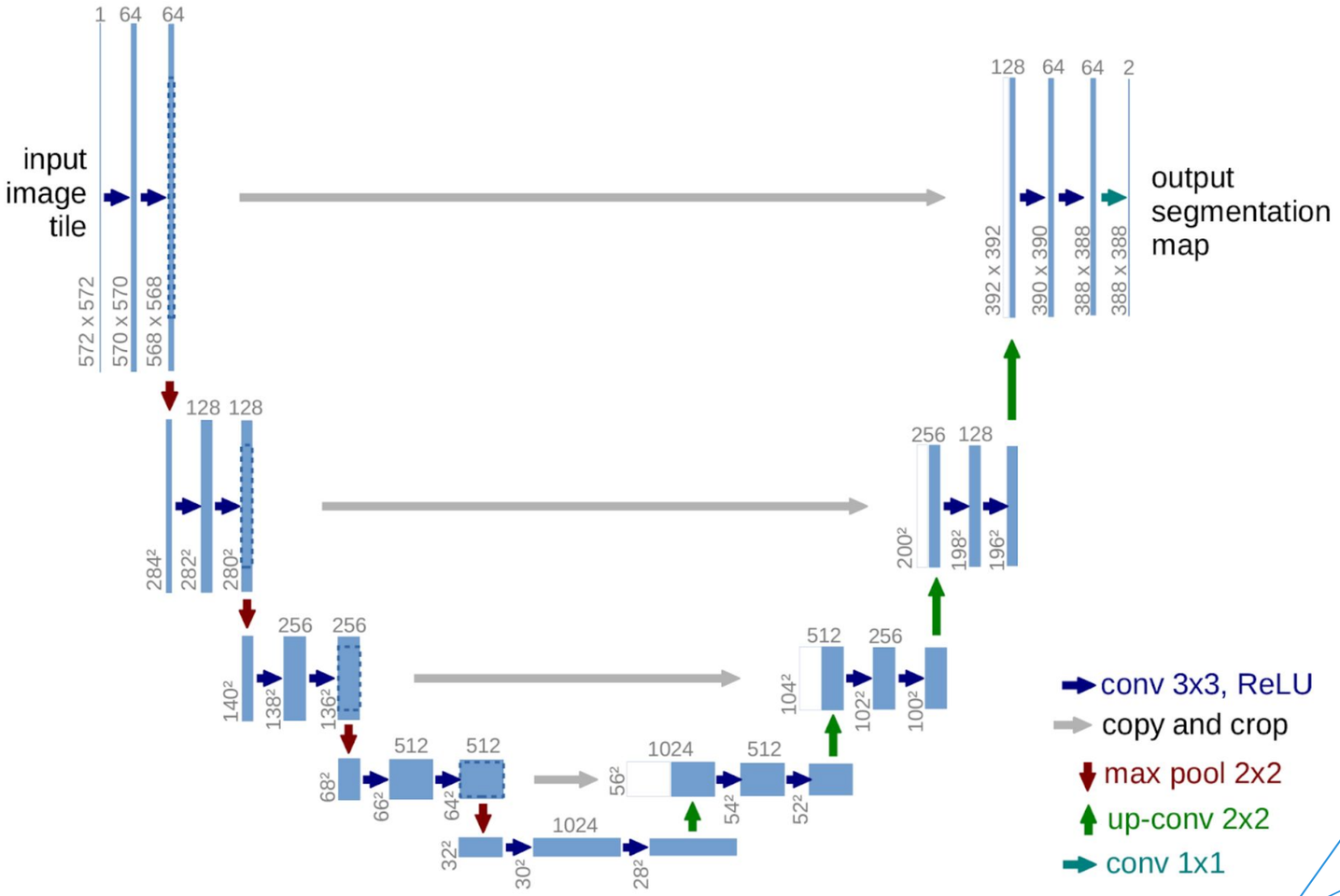


(c) Instance Segmentation

(d) Panoptic Segmentation

2. Approach

2.1 U-Net Architecture



3. Training and evaluation

3.1 Data collection

- **18,500** portraits for training
- **3,500** portraits for testing
- Image size: **128 x 128**

4.2 Model training

- **Epochs:** 5
- **Batch size :** 64 images

3. Training and evaluation

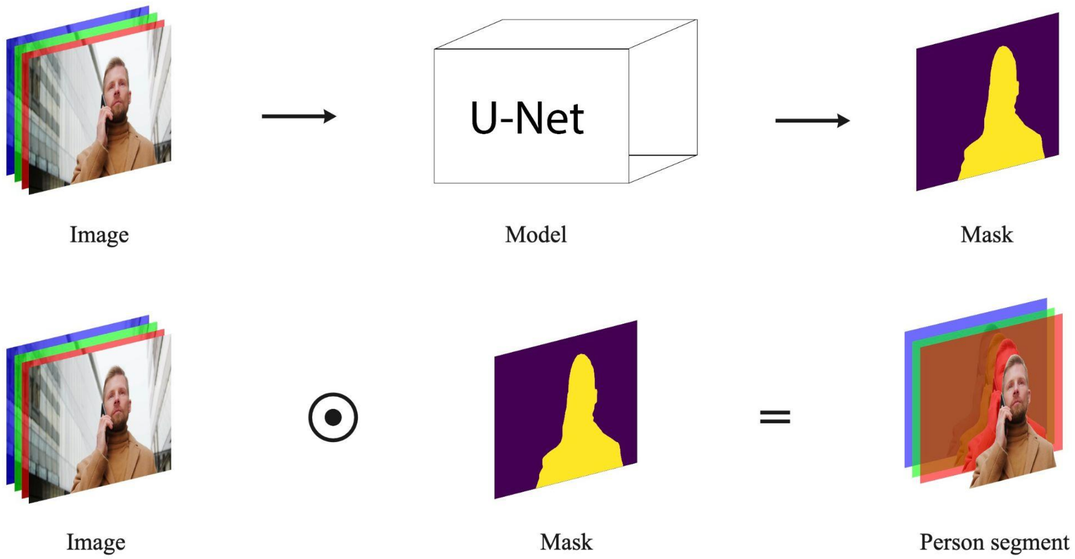
3.2 Evaluation

- **IoU Score:** 0.9648
- **Per-frame execution time**

Resolution (px.)	Mean value (sec.)	Median value (sec.)
128x128	0.077	0.073
256x256	0.15	0.147
512x512	0.545	0.538

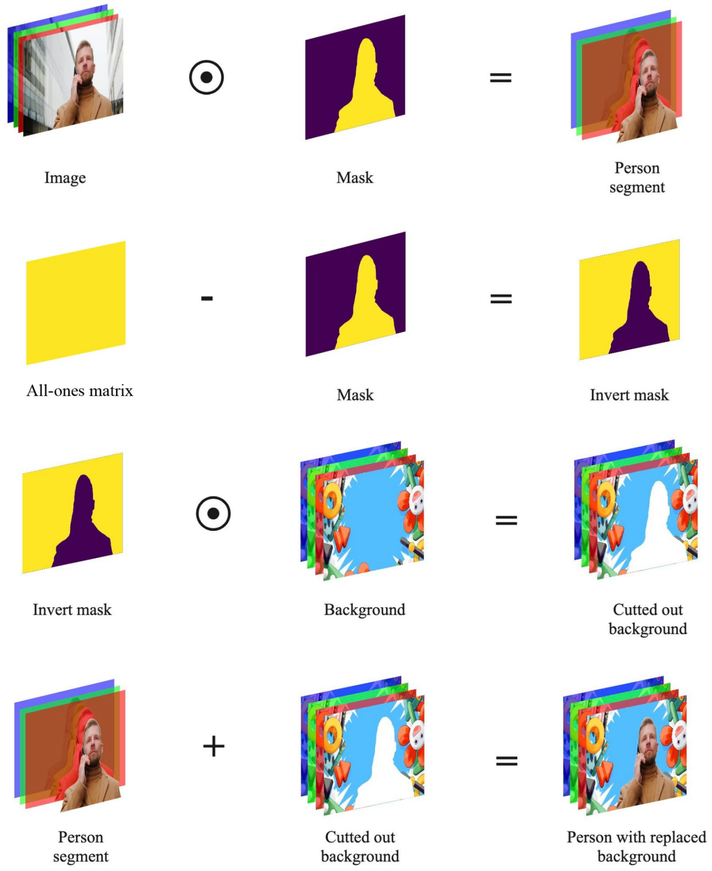
4. Effects

4.1 Background Removal



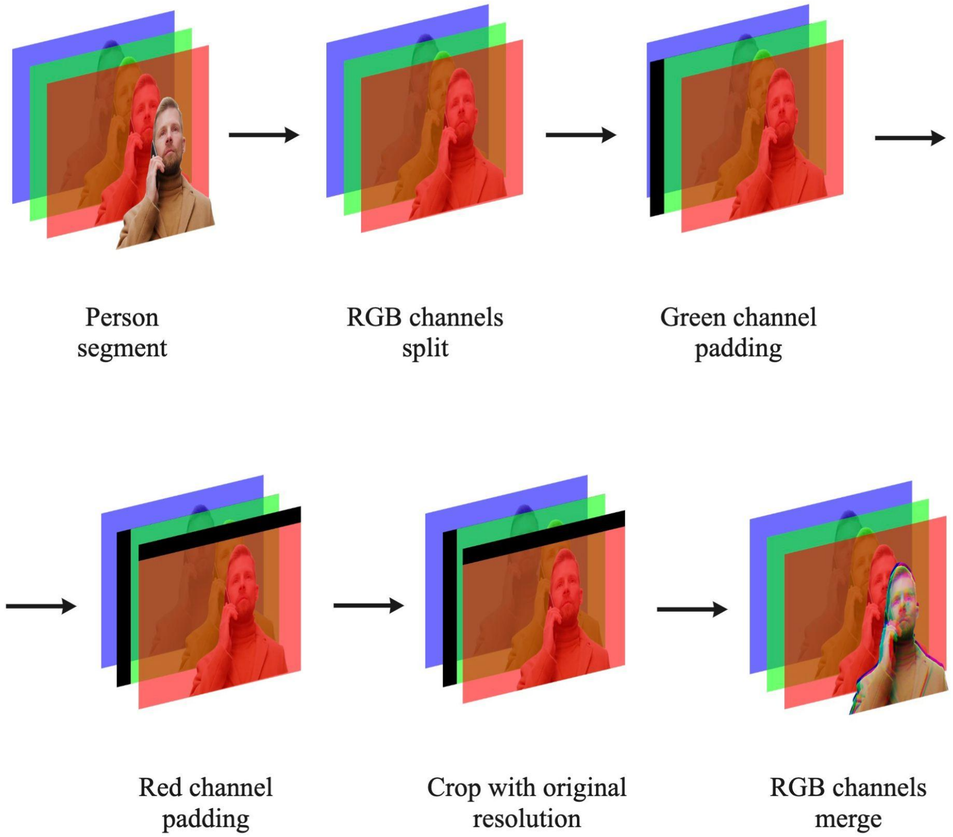
4. Effects

4.2 Background Replacement



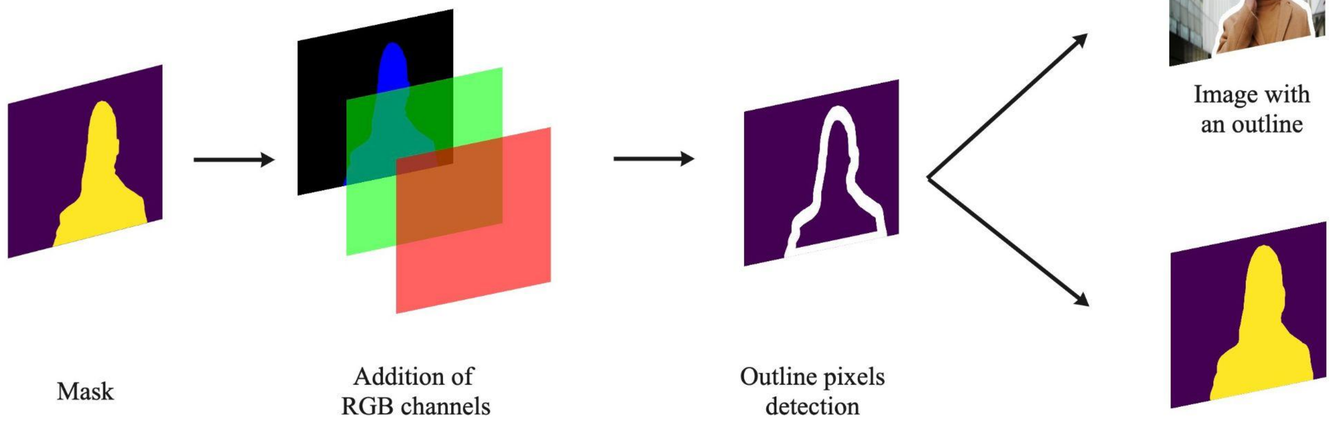
4. Effects

4.3 RGB Glitch



4. Effects

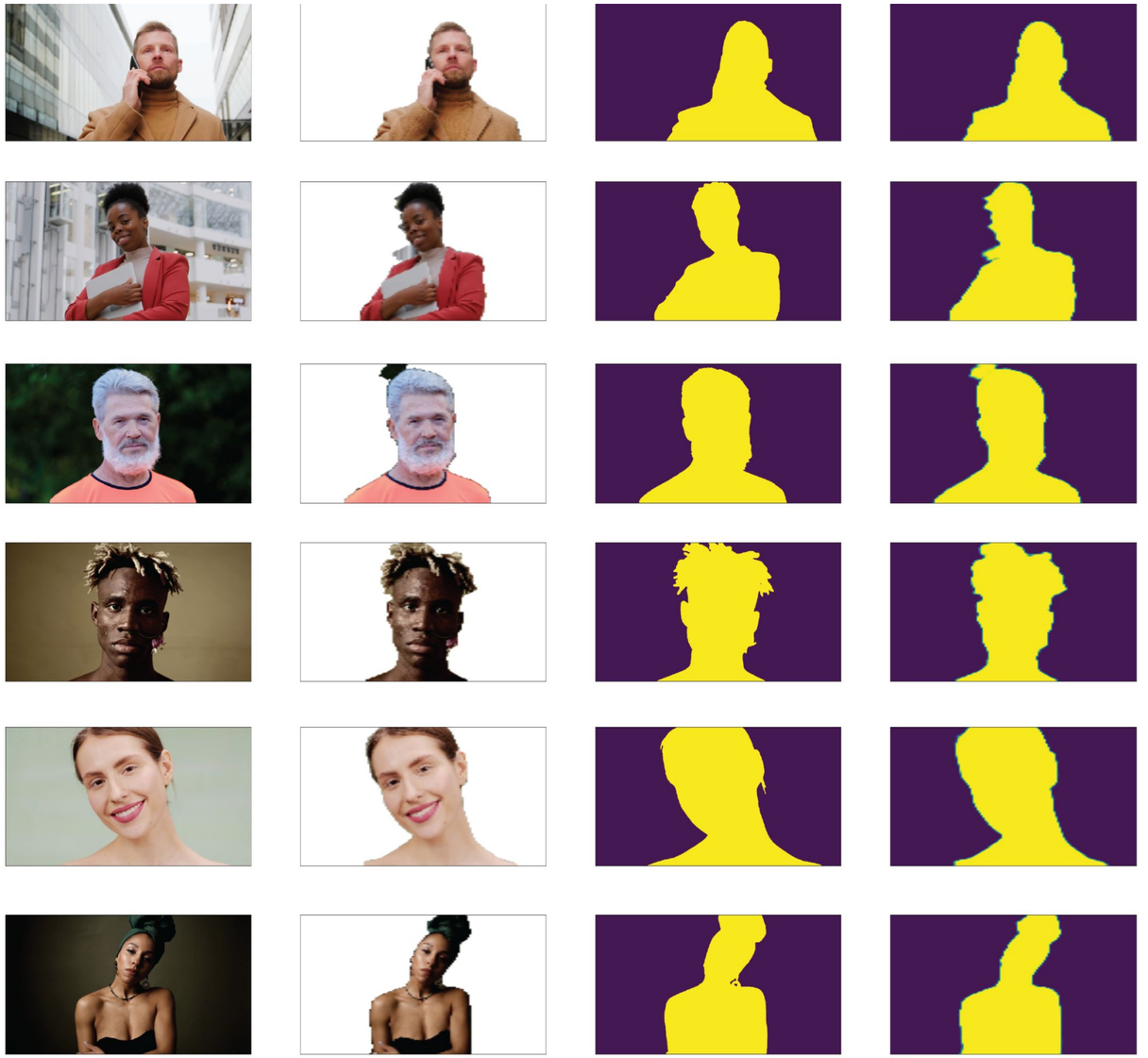
4.4 Person Outline



5. Results

5.1 Background removal

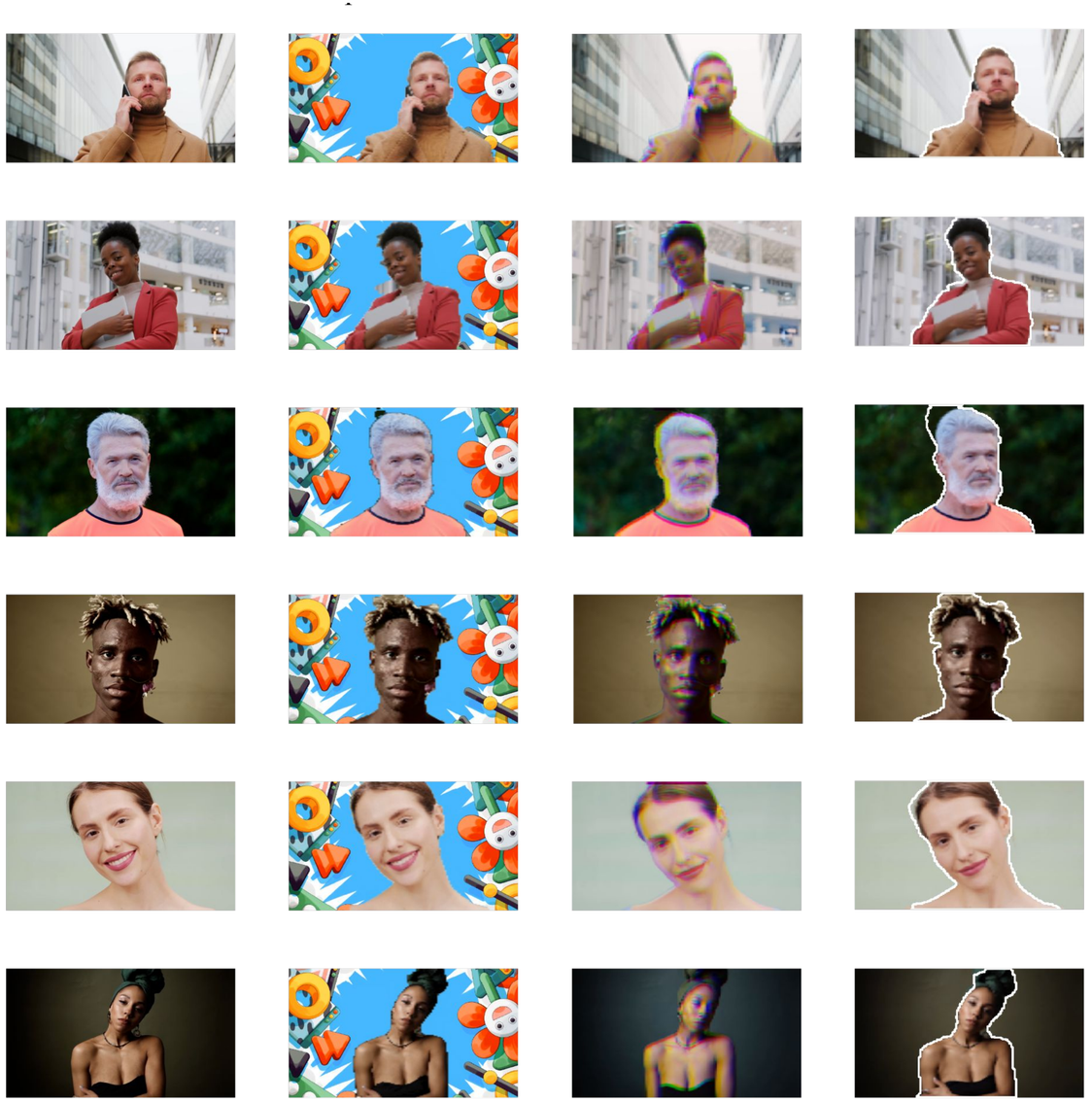
1st column - original image
2nd column - person segment
3rd column - ground truth image
4th column - person segment mask



5. Results

5.2 Effects on photos

1st column - original image
2nd column - background replacement
3rd column - RGB glitch
4th column - person outline



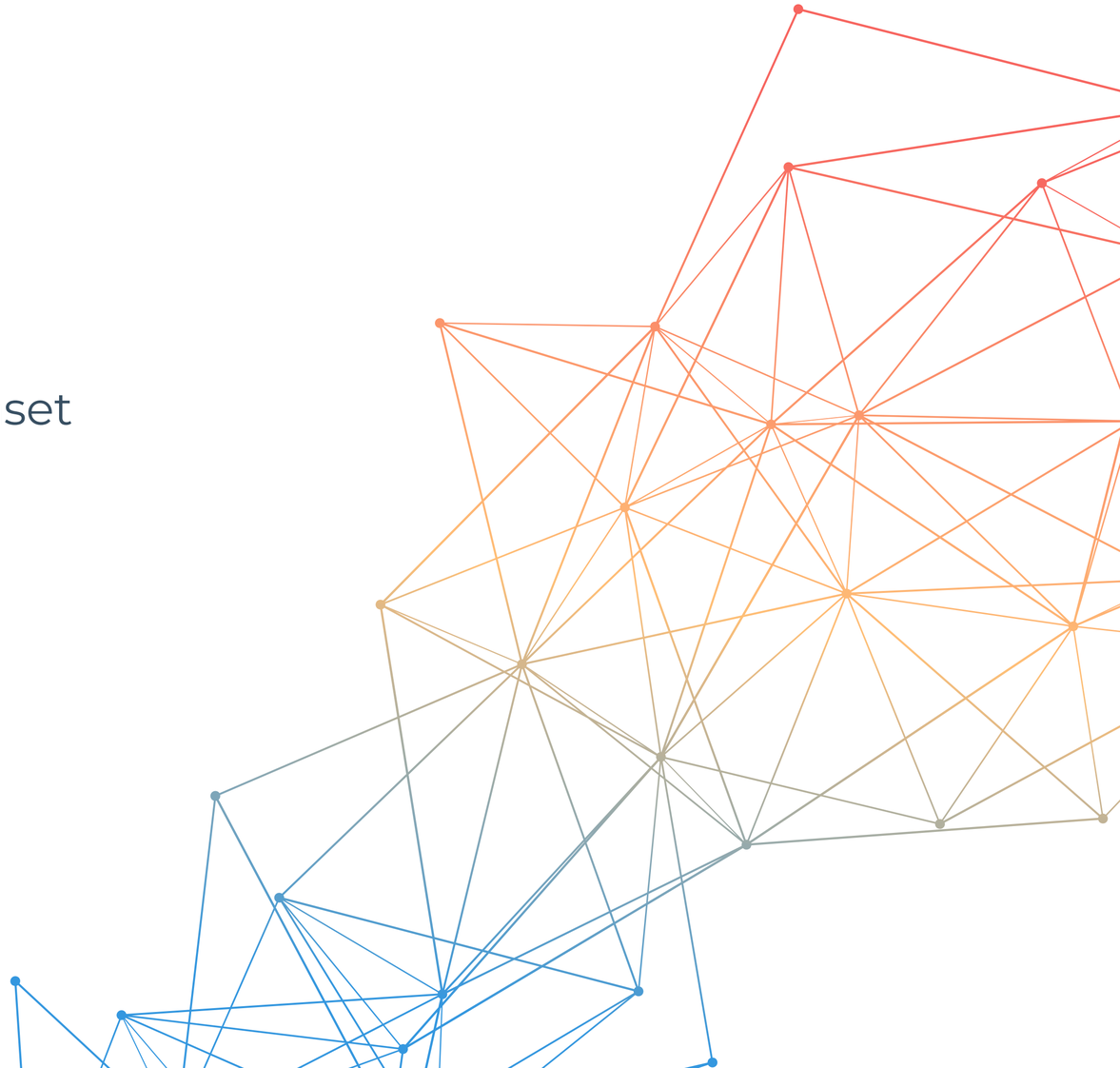
5. Results

5.3 Effects on video

6. Conclusion and further work

6.1 Suggestions

- **Training**-on a bigger resolution imagery
- Adding **full-body** images to training dataset
- Adding images with **multiple-people** to the dataset
- Adding imagery of people from **far away**



References

Al-amri, S. S., Kalyankar, N. V., & Khamitkar, S. D. (2010). Image Segmentation by Using Thershod Techniques. *JOURNAL of COMPUTING*, *2*(5). https://arxiv.org/pdf/1005.4020.pdf

Apple Inc. (2019, June). *Advances in Camera Capture & Photo Segmentation - WWDC19 - Videos*. Apple Developer. https://developer.apple.com/videos/play/wwdc2019/225?time=2714

Barla, N. (2022, May 16). *Panoptic Segmentation: Definition, Datasets & Tutorial [2022]*. Www.v7labs.com. https://www.v7labs.com/blog/panoptic-segmentation-guide

Battini, D. (2018, November 8). *Adam Optimization algorithms in Deep Learning*. Tech-Quantum. https://www.tech-quantum.com/adam-optimization-algorithms-in-deep-learning/?fbclid=IwAR10S_R-mR-Z-eERFlgUCN0YFxR1m3S8h8OBx53iLij033SNYxsvX8n68JI

Duque-Arias, D., Velasco-Forero, S., Deschaud, J.-E., Goulette, F., Serna, A., Decencière, E., & Marcotegui, B. (2021). On Power Jaccard Losses for Semantic Segmentation. *Proceedings of the 16th International Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Applications*, *5*. https://doi.org/10.5220/0010304005610568

Gupta, A., Harrison, P. J., Wieslander, H., Pielawski, N., Kartasalo, K., Partel, G., Solorzano, L., Suveer, A., Klemm, A. H., Spjuth, O., Sintorn, I., & Wählby, C. (2018). Deep Learning in Image Cytometry: A Review. *Cytometry Part A*, *95*(4), 366–380. https://doi.org/10.1002/cyto.a.23701

Kaushik, R., & Kumar, S. (2019). Image Segmentation Using Convolutional Neural Network. *International Journal of Scientific and Technology Research*, *8*(11). http://www.ijstr.org/final-print/nov2019/Image-Segmentation-Using-Convolutional-Neural-Network.pdf

Keymakr. (2021, May 8). *Instance vs. Semantic Segmentation: What Are the Key Differences?* Keymakr's Blog Features the Latest News and Updates. https://keymakr.com/blog/instance-vs-semantic-segmentation/

Kirillov, A., He, K., Girshick, R., Rother, C., & Dollár, P. (2019). *Panoptic Segmentation*. https://arxiv.org/pdf/1801.00868.pdf

Long, J., Shelhamer, E., & Darrell, T. (2015). *Fully Convolutional Networks for Semantic Segmentation*. https://arxiv.org/pdf/1411.4038.pdf

Prasad, S. (2020, May 31). *What is Image Segmentation or Segmentation in Image Processing?* Blogs & Updates on Data Science, Business Analytics, AI Machine Learning. https://www.analytixlabs.co.in/blog/what-is-image-segmentation/

Ramachandran, P., Zoph, B., & Le Google Brain, Q. (2017). *SEARCHING FOR ACTIVATION FUNCTIONS*. https://arxiv.org/pdf/1710.05941.pdf

Ronneberger, O., Fischer, P., & Brox, T. (2015, May 18). *U-Net: Convolutional Networks for Biomedical Image Segmentation*. ArXiv.org. https://arxiv.org/abs/1505.04597

Shapiro, L. G., & Stockman, G. C. (2000). *Computer vision: Image Segmentation* (pp. 305–351). Upper Saddle River Prentice Hall. http://nana.lecturer.pens.ac.id/index_files/referensi/computer_vision/Computer%20Vision.pdf

Sharif, M. S., Abbod, M., Amira, A., & Zaidi, H. (2010). Artificial Neural Network-Based System for PET Volume Segmentation. *International Journal of Biomedical Imaging*, *2010*(2010), 1–11. https://doi.org/10.1155/2010/105610

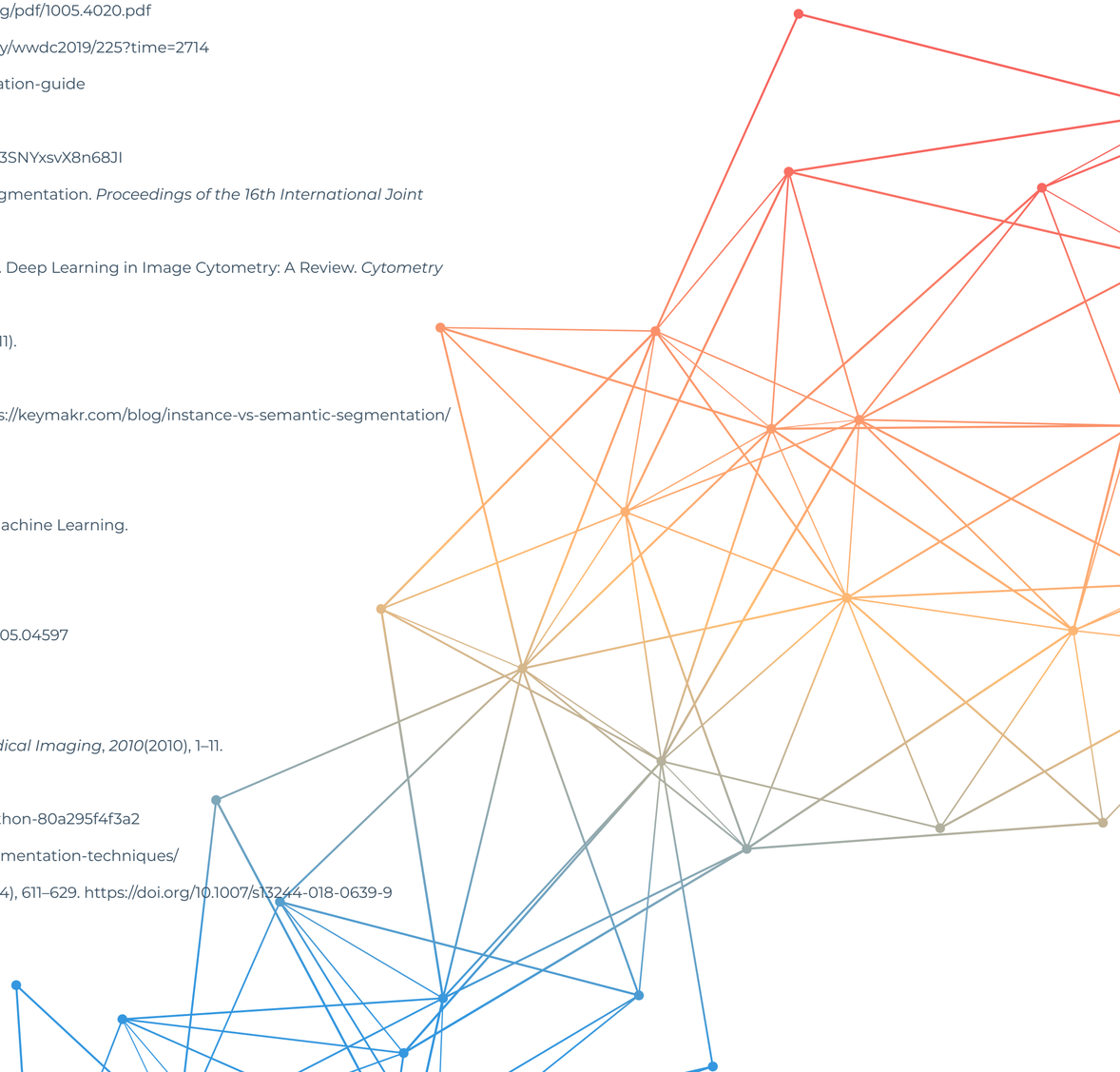
Sharma, M. (2020, May 4). *Cluster-based Image Segmentation -Python*. Medium. https://towardsdatascience.com/cluster-based-image-segmentation-python-80a295f4f3a2

Vadapalli, P. (2021, February 19). *Image Segmentation Techniques [Step By Step Implementation]*. UpGrad Blog. https://www.upgrad.com/blog/image-segmentation-techniques/

Yamashita, R., Nishio, M., Do, R. K. G., & Togashi, K. (2018). Convolutional neural networks: an overview and application in radiology. *Insights into Imaging*, 9(4), 611–629. https://doi.org/10.1007/s13244-018-0639-9

Yuheng, S., & Hao, Y. (2017). *Image Segmentation Algorithms Overview*. https://arxiv.org/pdf/1707.02051.pdf

Zhang, J. (2019, October 18). *UNet Line by Line Explanation*. Medium. https://towardsdatascience.com/unet-line-by-line-explanation-9b191c76baf5



THANK YOU!