

COMP 8740 Neural Networks  
Final Project Proposal

Complete Graph Distance (CGD) in Facial Keypoint  
Detection using Deep Learning

Hosnara Ahmed

U00744746

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# Complete Graph Distance (CGD) in Facial Keypoint Detection using Deep Learning

Facial Keypoint detection in face images has several applications such as face recognition, tracking faces in images, analyzing facial expressions, etc. In this project, we will implement a new loss function named Complete Graph Distance (CGD). The keypoints in a face image will be considered as nodes in a complete graph. The target of the loss function will be to minimize the distance between the actual and the predicted keypoints in that facial image. In general, MSE or RMSE are used as distance metric to calculate loss. However, in case of landmark detection of vertebrae in X-ray images, bipartite distance between the vertebrae incorporated with MSE performs better than just using MSE [1]. We will use Facial Keypoints Detection dataset (<https://www.kaggle.com/c/facial-keypoints-detection>) provided by Dr. Yoshua Bengio for this project.

For the modeling part, we will use pretrained ResNet [2] and DenseNet [3] as baseline models with MSE loss function. Then, we will apply CGD on the these models individually and observe the performance of CGD over MSE in facial keypoints detection.

## References

- [1] Abdullah-Al-Zubaer Imran, Chao Huang, Hui Tang, Wei Fan, Kenneth M. C. Cheung, Michael To, Zhen Qian, and Demetri Terzopoulos. Bipartite distance for shape-aware landmark detection in spinal x-ray images, 2020.
- [2] Kaiming He, Xiangyu Zhang, Shaoqing Ren, and Jian Sun. Deep residual learning for image recognition, 2015.
- [3] Gao Huang, Zhuang Liu, Laurens van der Maaten, and Kilian Q. Weinberger. Densely connected convolutional networks, 2018.