MODIFIED LOSS FUNCTION FOR FACE RECOGNITION

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Introduction:

CosFace - Large Margin Cosine Loss (LMCL). LMCL is a machine learning and deep learning technique primarily used for face recognition and image classification tasks. It is a specialized loss function designed to enhance the performance of deep neural networks in these applications. The main objective of LMCL is to improve the discrimination between different classes of data, making it particularly effective in scenarios where high accuracy and precision are crucial. Unlike traditional softmax loss functions, which are commonly used in image classification, LMCL focuses on maximizing the cosine similarity between the feature embeddings of the correct class and the input data while creating a large margin between the feature representations of the correct class and other classes. This results in better class separation, making it easier for the

model to distinguish between different classes, especially when dealing with large datasets with many categories.

$$L_s = \frac{1}{N}\sum_{i=1}^{N} -\log p_i = \frac{1}{N}\sum_{i=1}^{N} -\log \frac{e^{f_{y_i}}}{\sum_{j=1}^{C} e^{f_j}},$$

Drawbacks:

Sensitivity to Hyperparameters: CosFace requires careful tuning of hyperparameters such as the margin parameter and the scale parameter. The performance of the model can be highly dependent on these hyperparameters, and finding the right values can be a challenging and time-consuming task.

Overfitting: Like many other loss functions in deep learning, CosFace can lead to overfitting if not properly regularized or when trained on small datasets. Overfitting can result in poor generalization of unseen data.

Modified loss function:

Loss =

$$\sum_{i=1}^{n} \frac{s\cos^{-1}((\cos(\theta y_i) - m)/M)}{n}$$

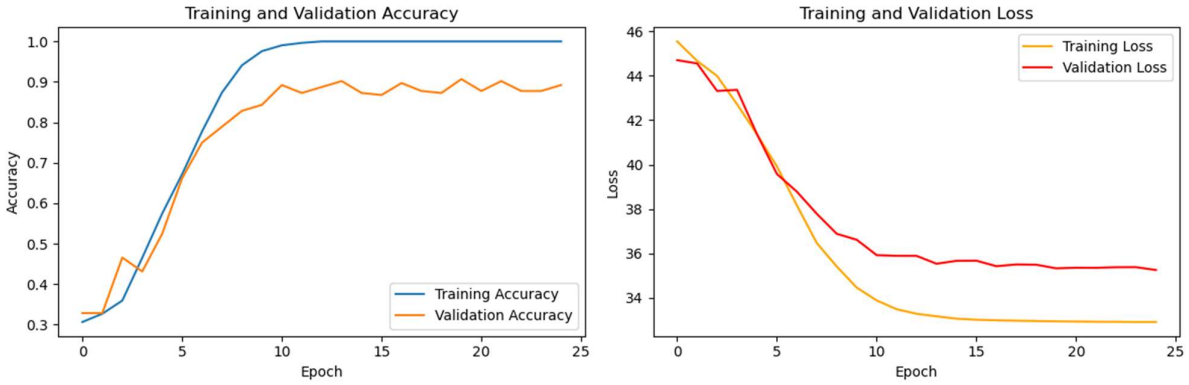
Where m = margin, M = e^m, s = scale

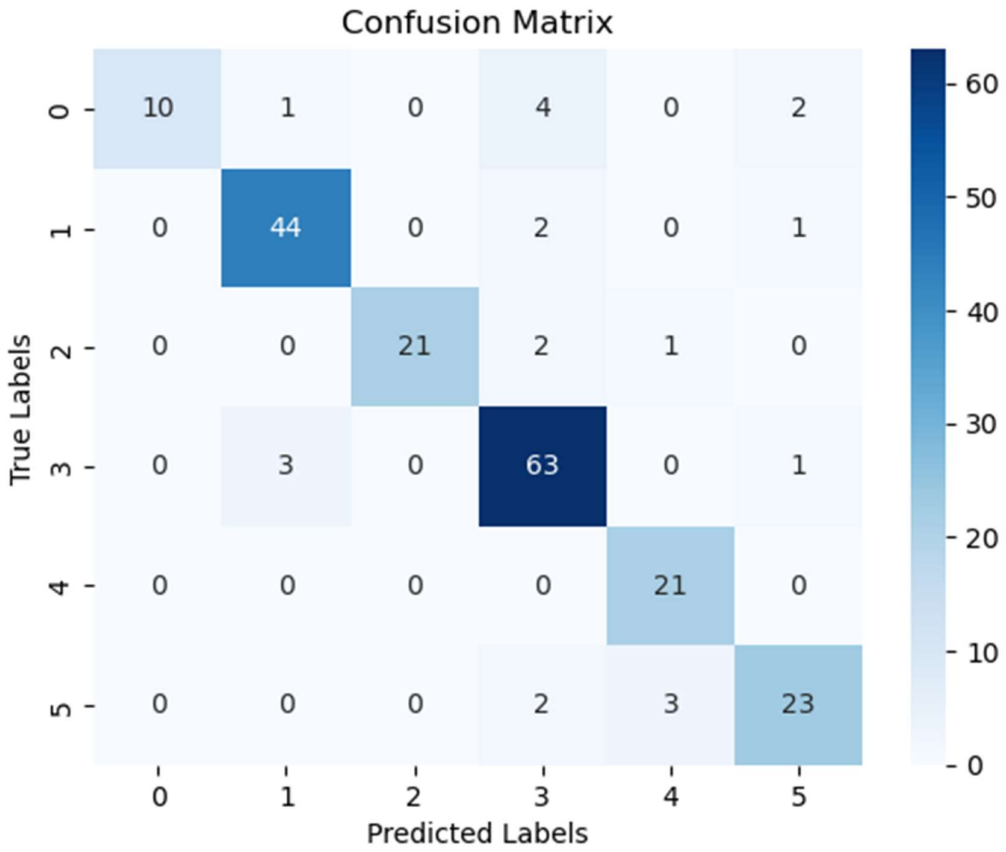
We have combined both additive and multiplicative margin to make a new loss function. This loss function has a term -m which is the additive margin which helps to increase the inter class distance and M which is the multiplicative margin which further increases interclass distance and reduces the intra-class distance.

This variant encourages the network to increase the angular separation between the feature vectors of the true class and the non-true classes, making the feature embeddings more discriminative.

Performance:

CNN Face Recognition model using Modified Cosine Loss Function trained on LFW_dataset with no. of persons = 6.





Classification Report:

	precision	recall	f1-score	support
Ariel_Sharon	1.00	0.59	0.74	17
Colin_Powell	0.92	0.94	0.93	47
Donald_Rumsfeld	1.00	0.88	0.93	24
George_W_Bush	0.86	0.94	0.90	67
Gerhard_Schroeder	0.84	1.00	0.91	21
Tony_Blair	0.85	0.82	0.84	28
accuracy			0.89	204
macro avg	0.91	0.86	0.87	204
weighted avg	0.90	0.89	0.89	204