XFMR

Explainable Face Mask Recognition

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Outline

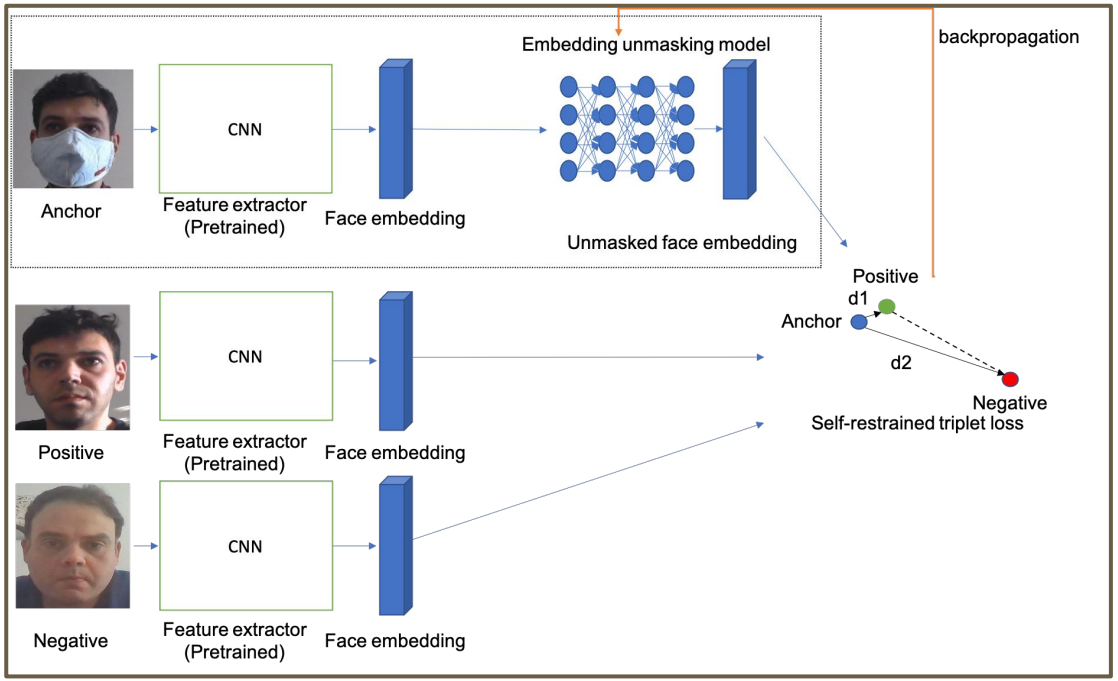
1) Face Mask Recognition Problem
2) Explainable AI
3) ArcFace and Mask generation
4) Framework - Explainable Cosine Similarity
5) LayerCAM

Face Mask Recognition

- According to a study carried out by the **National Institute of Standards and Technology (NIST)**, algorithm accuracy with masked faces declined substantially across the board. Most accurate algorithms fail to authenticate a person about 0.3% of the time. Masked images increased the failure rate to about 5% for top algorithms , while many otherwise competent algorithms failed between 20% to 50% of the time.

- Face recognition algorithms typically work by measuring a face's features — their size and distance from one another, for example — and then comparing these measurements to those from another photo.

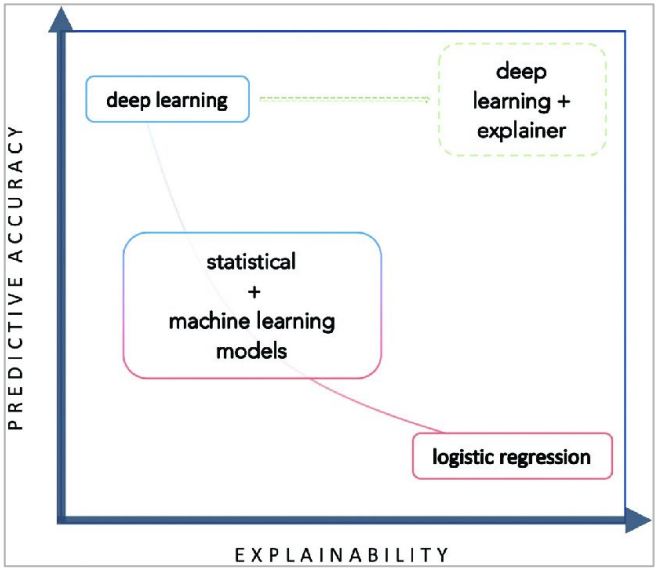
- The more of the nose a mask covers, the lower the algorithm's accuracy



Self-restrained Triplet Loss (SRT) to guide the EUM during the training phase. The SRT shares the same learning objective with the triplet loss i.e. it enables the model to minimize the distance between genuine pairs and maximize the distance between imposter pairs.

Fadi Boutros et al. “Self-restrained triplet loss for accurate masked face recognition”, Pattern Recognition, Volume 124,

Explainable AI

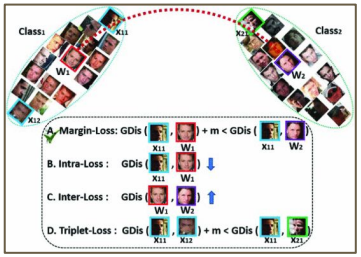


While deep learning has facilitated unprecedented accuracy in image classification, object detection, and image segmentation, one of their biggest problems is **model interpretability**. In practice, deep learning models are treated as "black box" methods, and many times we have no reasonable idea as to:

- Where the network is "looking" in the input image
- Which series of neurons activated in the forward-pass during inference/prediction
- How the network arrived at its final output

- That raises an interesting question — *how can you trust the decisions of a model if you cannot properly validate how it arrived there?* This is where **Explainable AI (XAI)** comes in. An XAI-system can be defined as "a self-explanatory intelligent system that describes the reasoning behind its decisions and predictions".

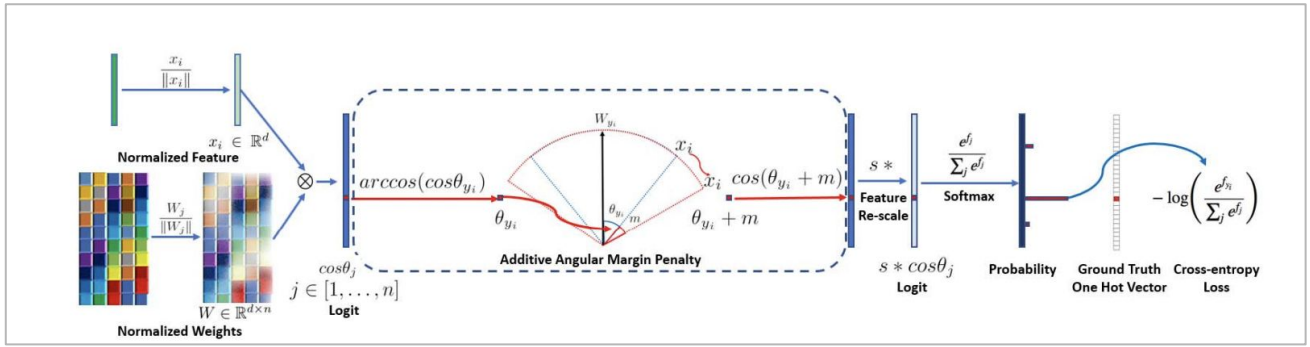
ArcFace Model



What is ArcFace?

- Propose an **Additive Angular Margin Loss** (ArcFace), which is exactly corresponded to the geodesic distance (Arc) margin penalty in (A),

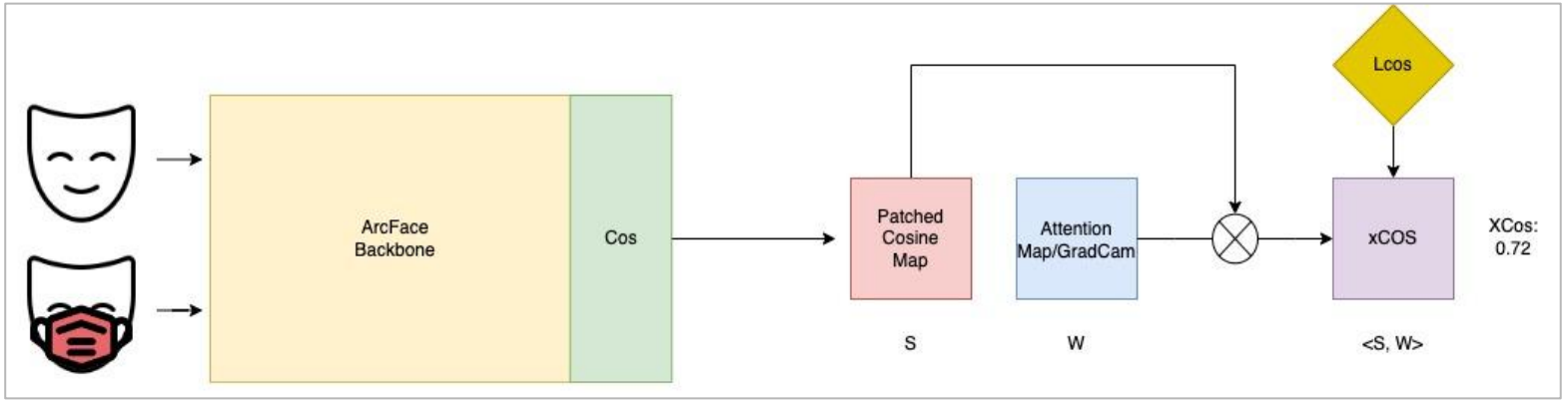
- learn directly an **embedding**, such as the triplet loss
- Dataset - VGGFace2 (pre-trained model)



J. Deng et al. "ArcFace: Additive Angular Margin Loss for Deep Face Recognition," CVPR, 2019

Framework - Explainable Cosine Similarity

- The models equipped with the proposed module allow the user to visualize the **similarity map** between two people for each part of a face and can explain ArcFace model.
- Produce the **final similarity score** <S, W>
- Addressing explainability from perspective of **local similarity** and **model attention** while trying to preserve good model performance.



LayerCAM

- **Grad-CAM** generates heatmaps for a class label by finding the final convolutional layer in the network and then examining the gradient information flowing into that layer.
- **LayerCAM** is a simple modification of Grad-CAM, which can generate reliable class activation maps from different layers.

P. -T. Jiang, C. -B. Zhang, Q. Hou, M. -M. Cheng and Y. Wei, "LayerCAM: Exploring Hierarchical Class Activation Maps for Localization," TIP, 2021

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Thank you!