“Seismic Image Retrieval and Classification using Novel Data Augmentation”

SALIQ GOWHAR - 211AI043
SATYAM AGRAWAL - 211AI044
SHASHANK REDDY MUPPIDI - 211AI033

INTRODUCTION & MOTIVATION

- Limited research in the field of Seismic Images and Geophysics coupled with Deep Learning.
- Seismic images are complex to understand and its hard to derive hypothesis about the Earth in the survey area directly from them.
- Computer vision has the capabilities to extract potential features from complex set of images to help derive conculsions about the Earth in the survey area.
- Considering a dataset with known conclusions about the images, Computer vision algorithms can help identitfy the similarities and the images that closely resemble the target image.

DATASET DESCRIPTION

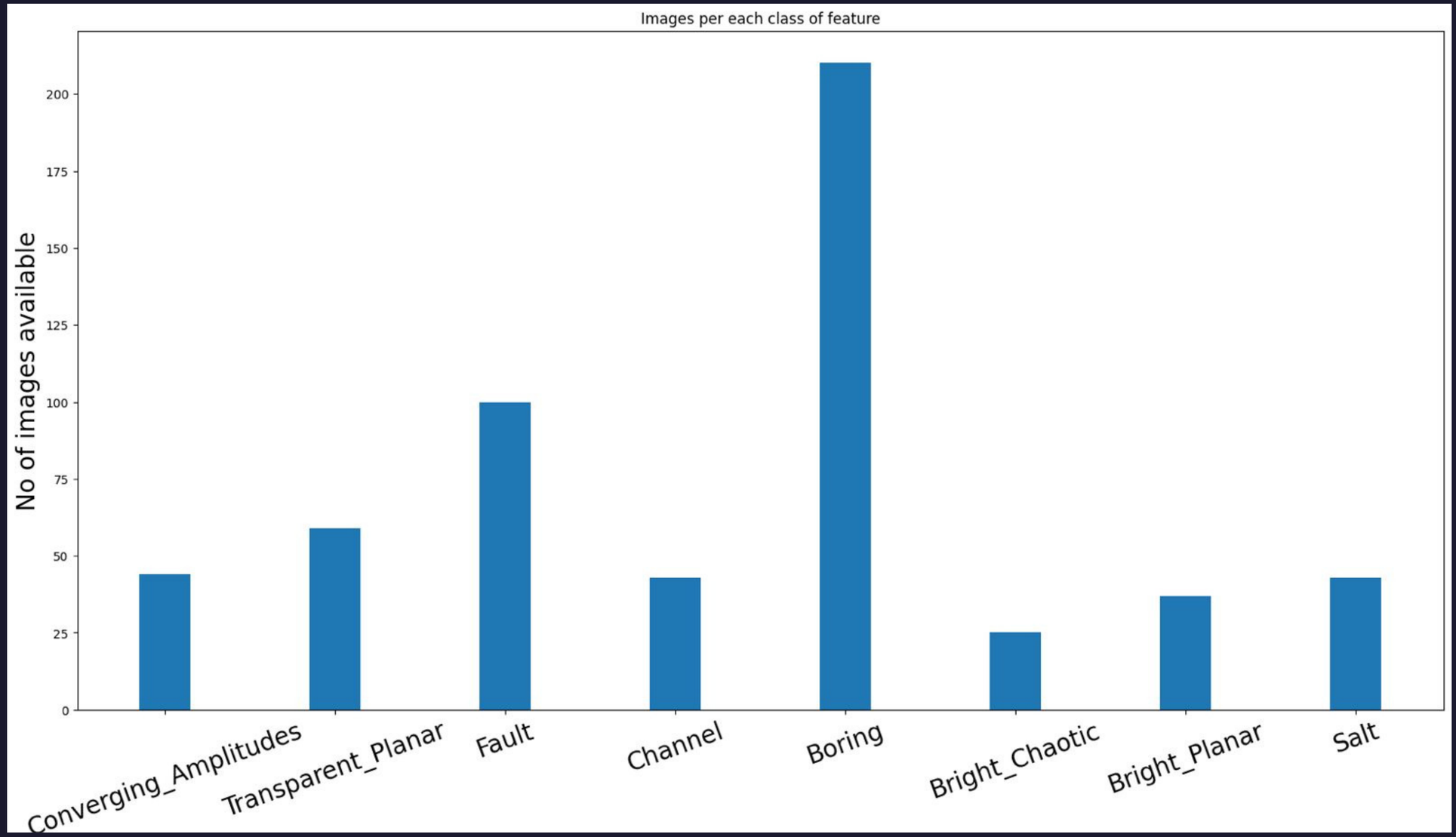
- The dataset is taken from the official competition page.
  Link: https://thinkonward.com/app/c/challenges/reflection-connection/data

- The Training dataset comprises a total of 561 images that belong to one of the eight classes: Converging amplitudes, Fault, Boring, Channel, Bright Classic, Bright Planar, Salt,Transparent Planar.

- The Testing dataset comprises of two sections: Query and Image Corpus.

- Images are of varying sizes.

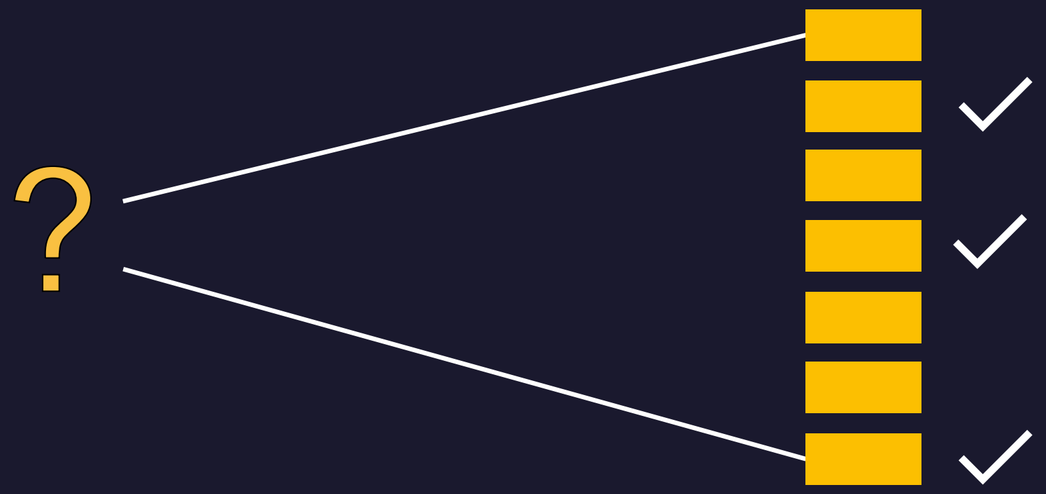
DATASET DESCRIPTION



OBJECTIVES

The project aims at:

- Classification of Images where for every image in the Query Corpus we have to figure out the top 3 most similar images from the Image Corpus along with the specific confidence score.

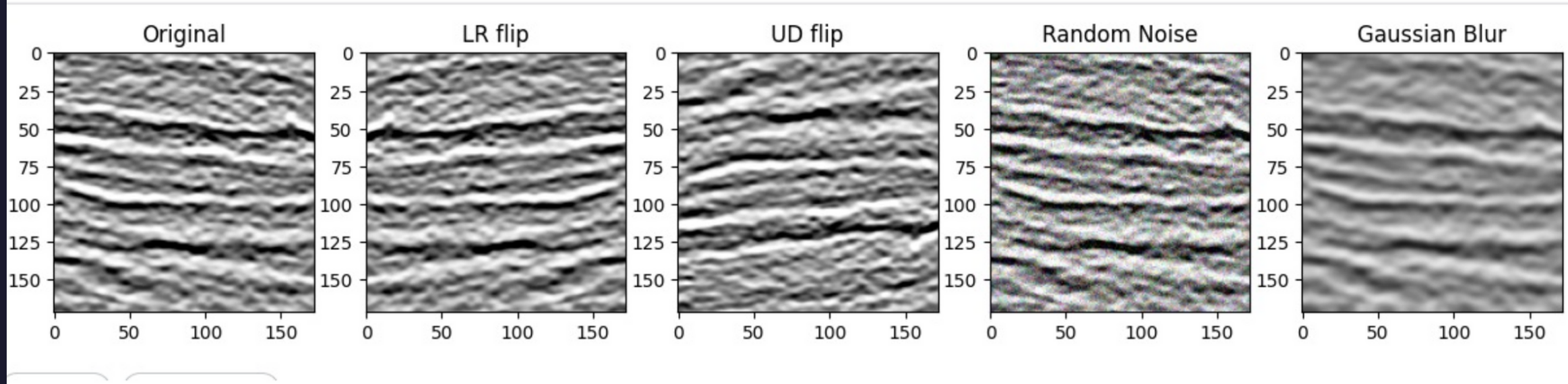


Preprocessing the Images

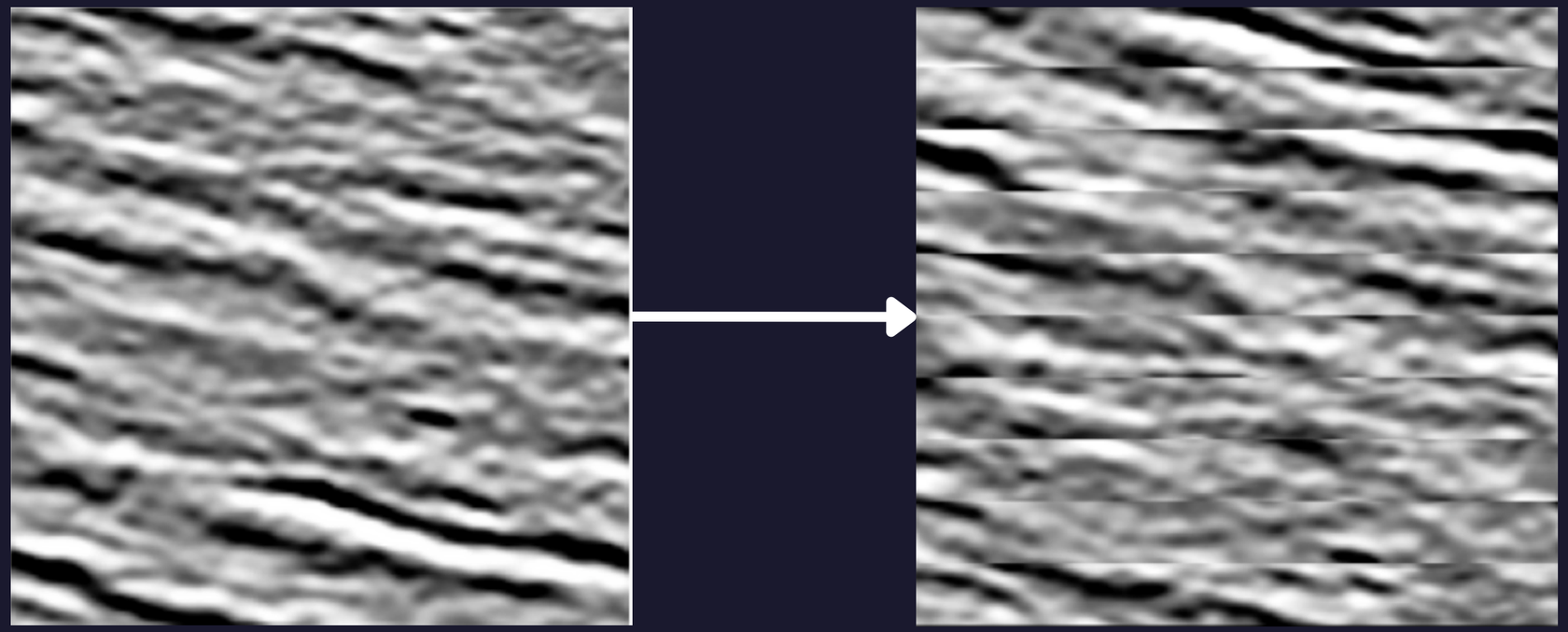
- Image Resized - For pre-trained architecture requirements
- Image Sharpened - To make the lines more distinct and explicit

```
def preprocess_image(image_path, label):
    image = Image.open(image_path).convert('RGB')
    width, height = image.size
    new_size = 224
    image = image.resize((pad, pad))
    image = image.filter(ImageFilter.SHARPEN)
    image = np.array(image)
    data.append(image)
    labels.append(label)
```

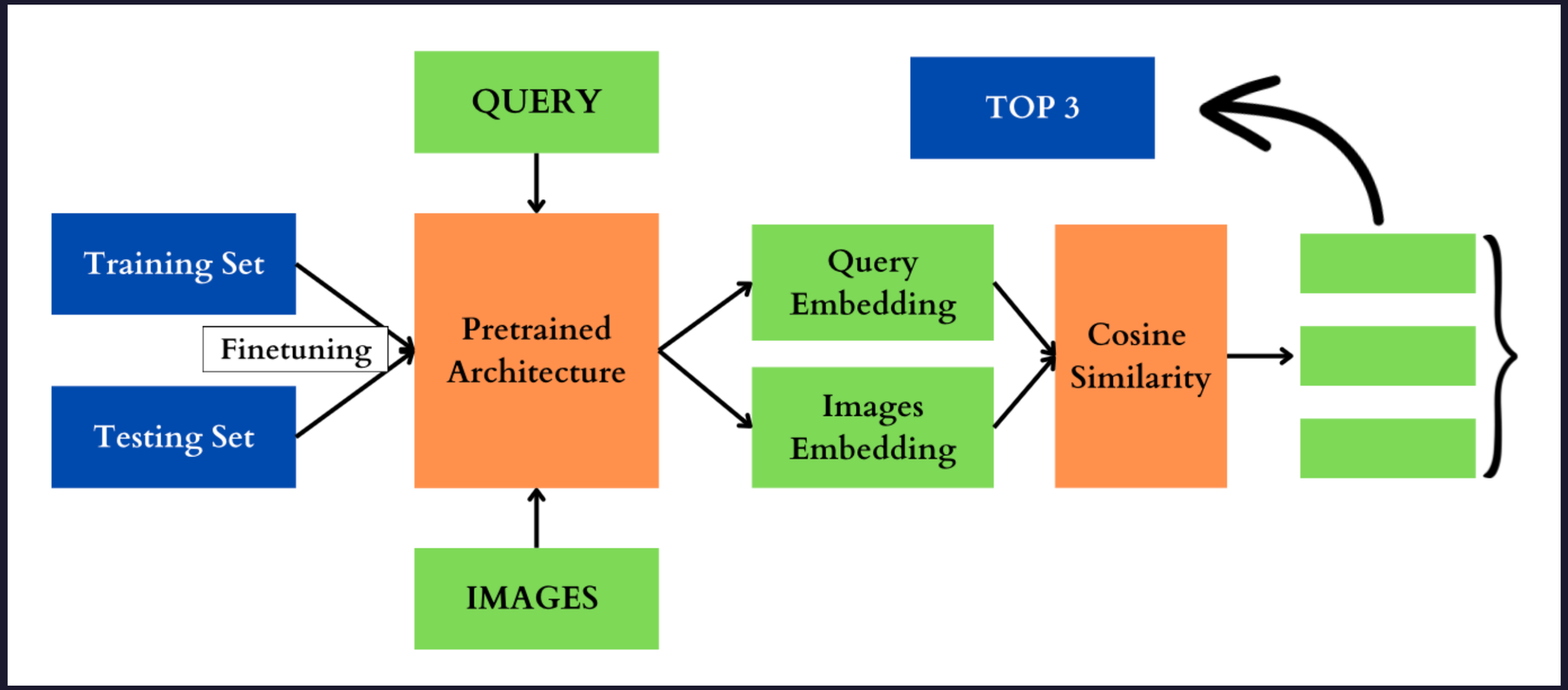
Data Augmentation Techniques



Novel Data Augmentation Technique

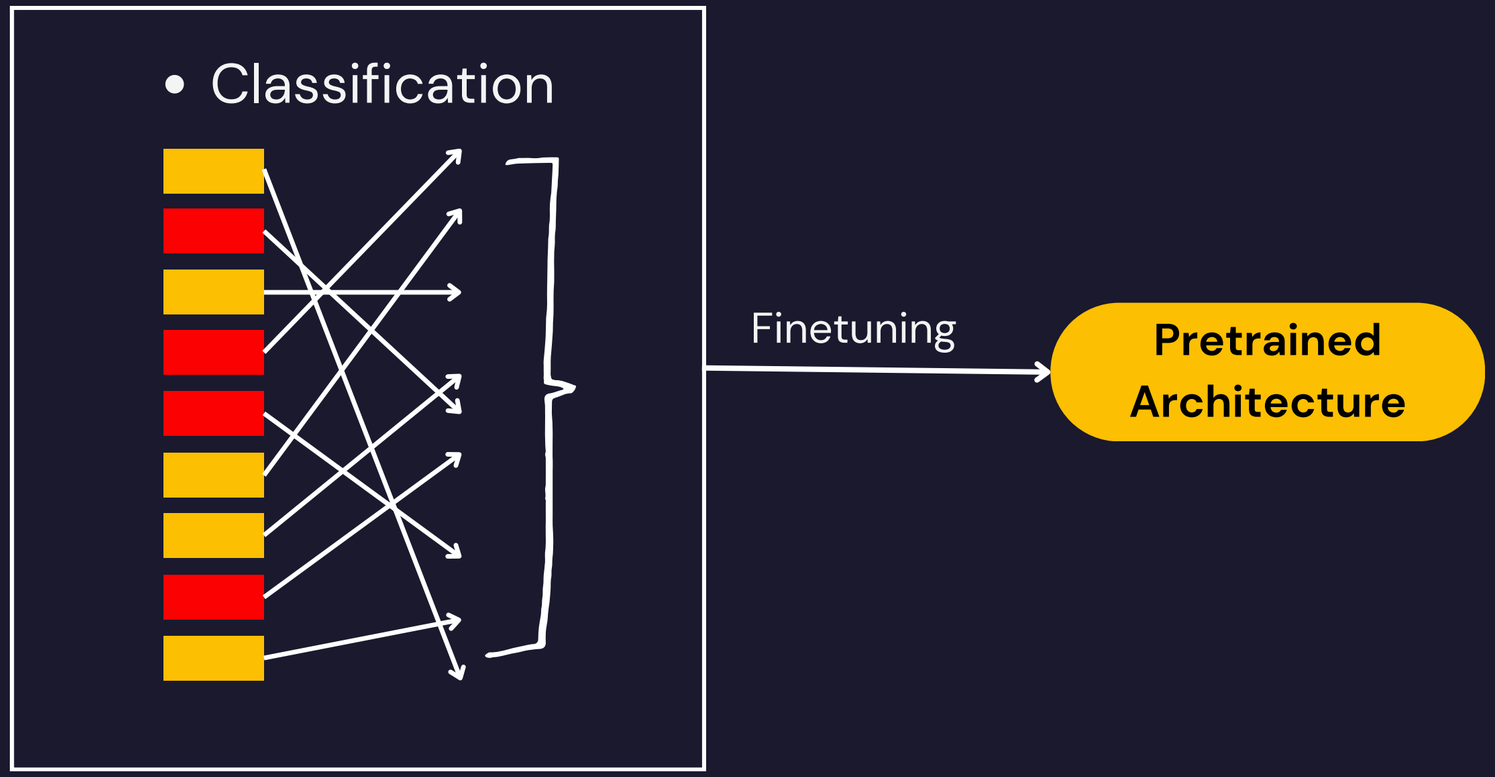


TRANSFER LEARNING



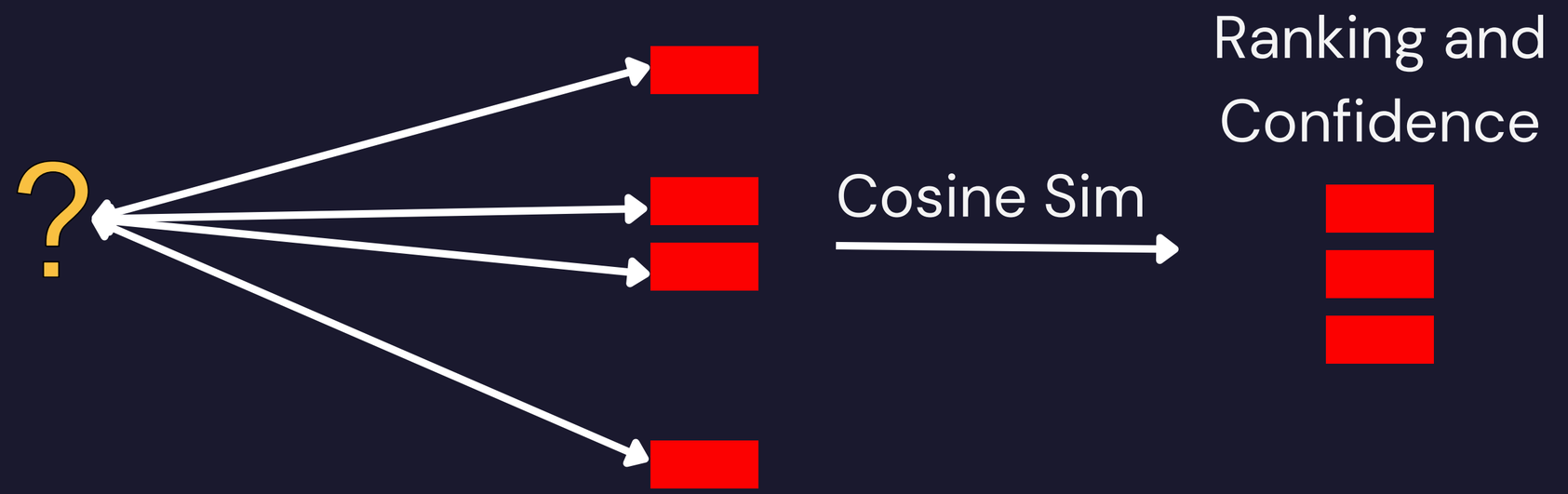
OUTLINE OF THE APPROACH

- Use of Freeform classification to fine tune the pre-trained model.



OUTLINE OF THE APPROACH

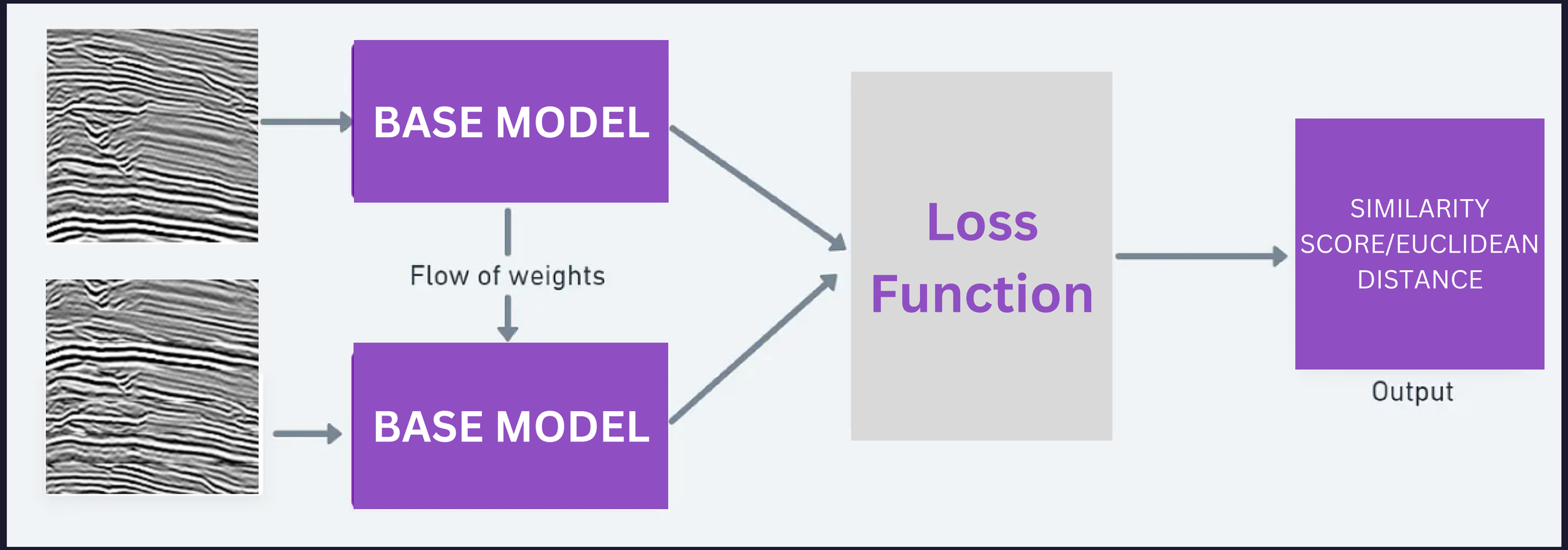
- Use of Embeddings obtained from the pre-trained architecture along with Cosine Similarity to obtain confidence scores for each of the matched images and select the top 3.



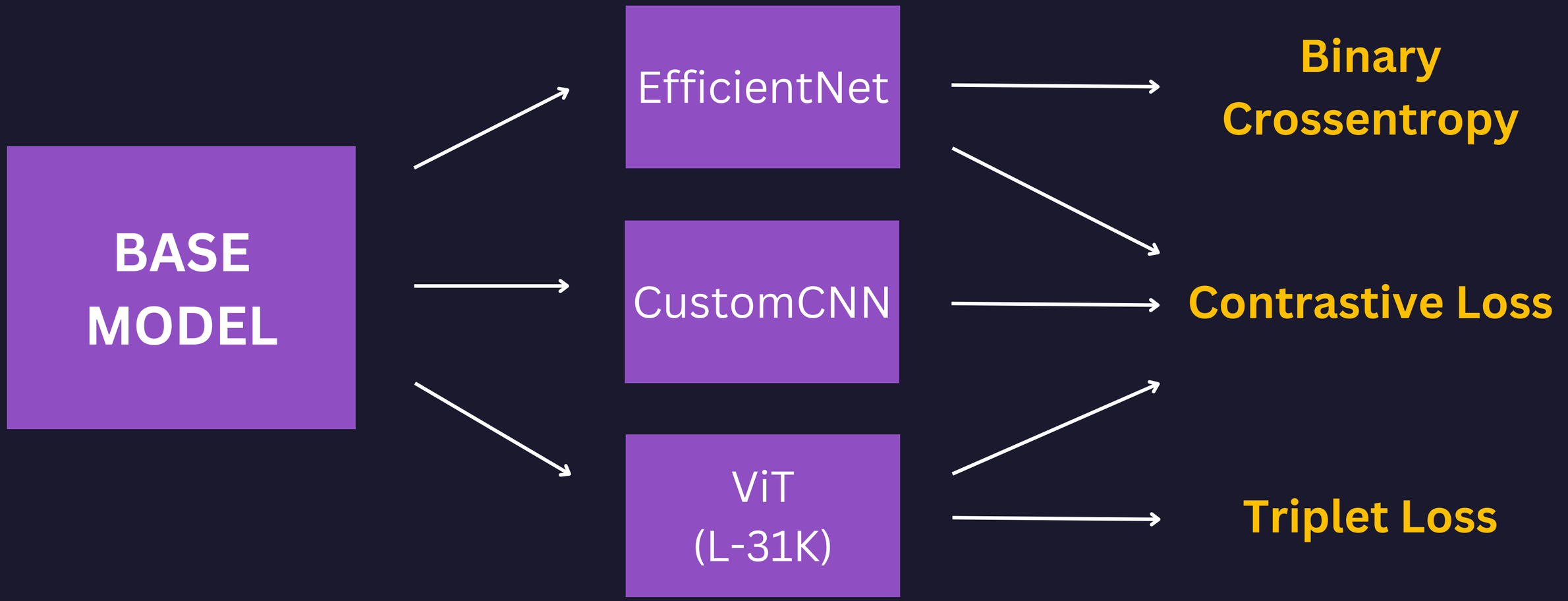
RESULTS

Pretrained Architecture	Macro F1	Accuracy (%)
VGG 16	0.06	29
VGG 19	0.06	29
InceptionV3	0.48	57
ResNet50	0.46	57
ResNet50V2	0.50	58
Xception	0.58	64
InceptionResNetV2	0.61	70
EfficientNetB0	0.54	64
EfficientNetB0 (A)	0.59	68
EfficientNetB1	0.60	68
EfficientNetB1 (A)	0.65	75
EfficientNetB2	0.59	66
EfficientNetB2 (A)	0.64	72
EfficientNetB3	0.61	69
EfficientNetB3 (A)	0.62	68
EfficientNetB4	0.61	67
EfficientNetV2B0	0.61	68
EfficientNetV2B1	0.60	69
EfficientNetV2B2	0.60	67
EfficientNetV2B3	0.60	67
EfficientNetV2S	0.57	65
EfficientNetV2S (A)	0.63	73

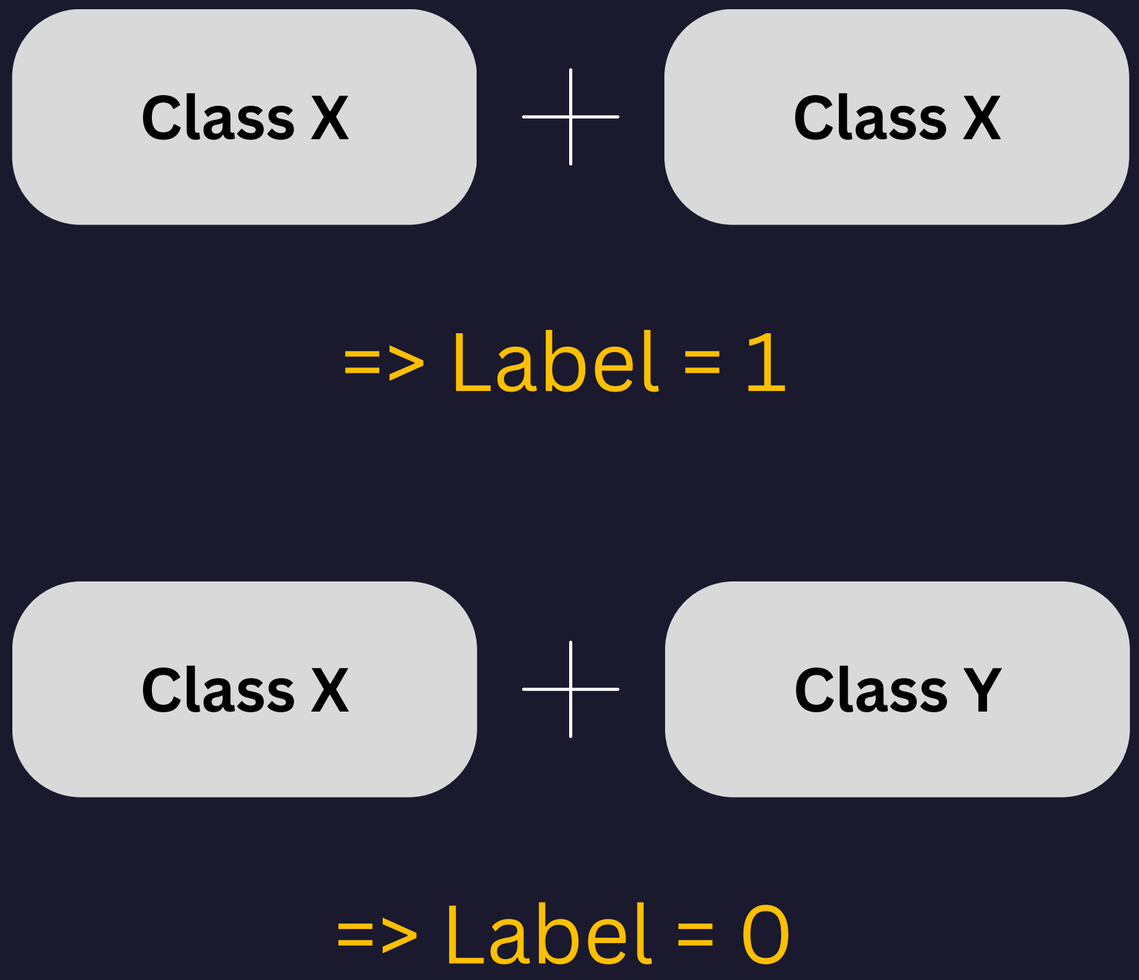
SIAMESE NEURAL NETWORK

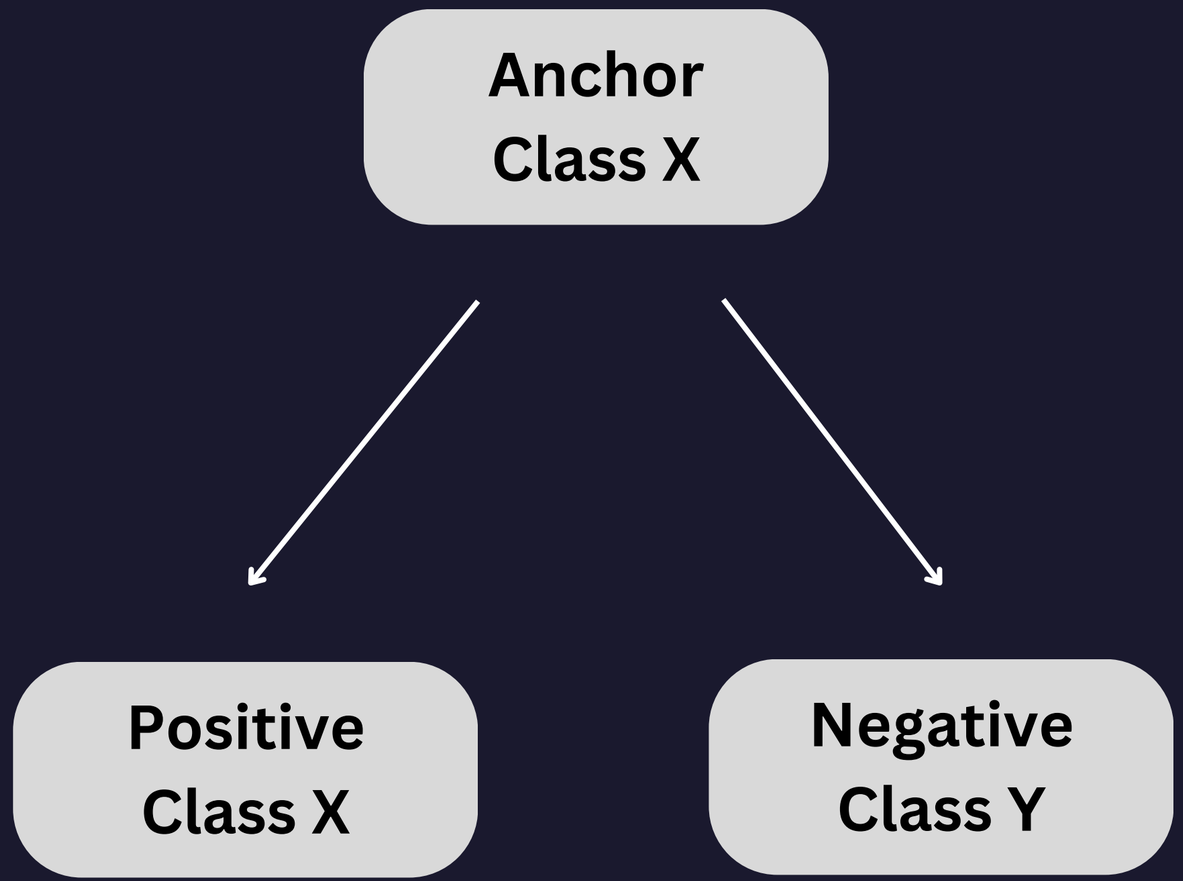


SIAMESE NEURAL NETWORK



SIAMESE NEURAL NETWORK





RESULTS FOR SIAMESE NETWORKS

Approach	Leaderboard Score
Siamese Network with ViT and CL	0.3275
Siamese Network with ViT and TL	0.2727
Siamese Network with EffNet and CL	0.2214
Siamese Network with Custom CNN and CL	0.2090
Siamese Network with EffNet and BC	0.1160
Siamese Network with EffNet and TL	0.1150

THANK YOU