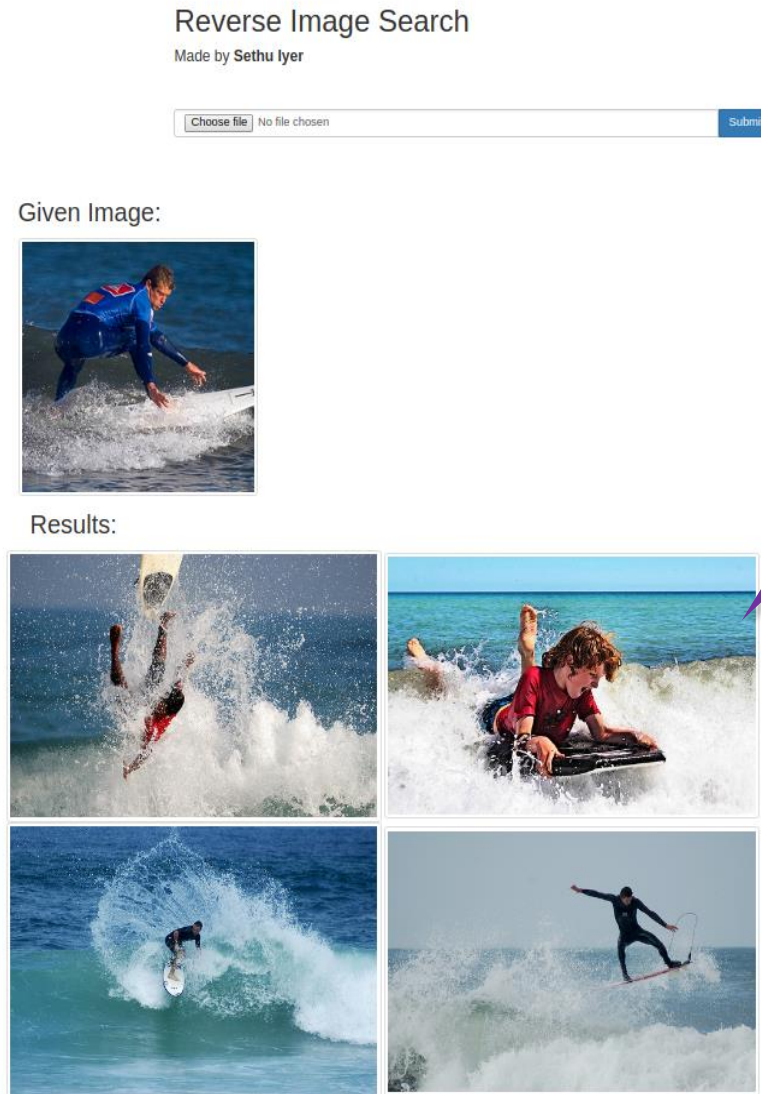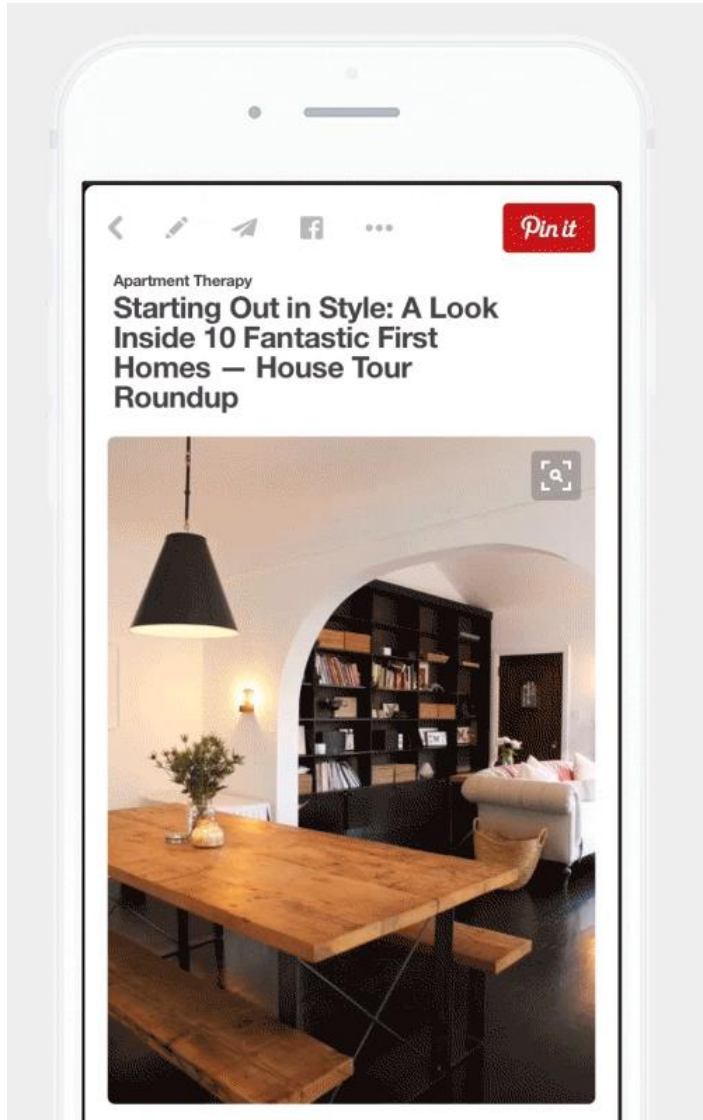# Agenda :

1. Application oriented outcome :
   - Building Image based search engine using metric learning
   - Hands-on implementation of Siamese neural network using TensorFlow
2. Conceptual learnings
   - Meta Learning
   - Metric Learning
   - Siamese Networks

Have you come across these use cases?

Reverse Image Search
Made by **Sethu Iyer**

Choose file | No file chosen   Submit
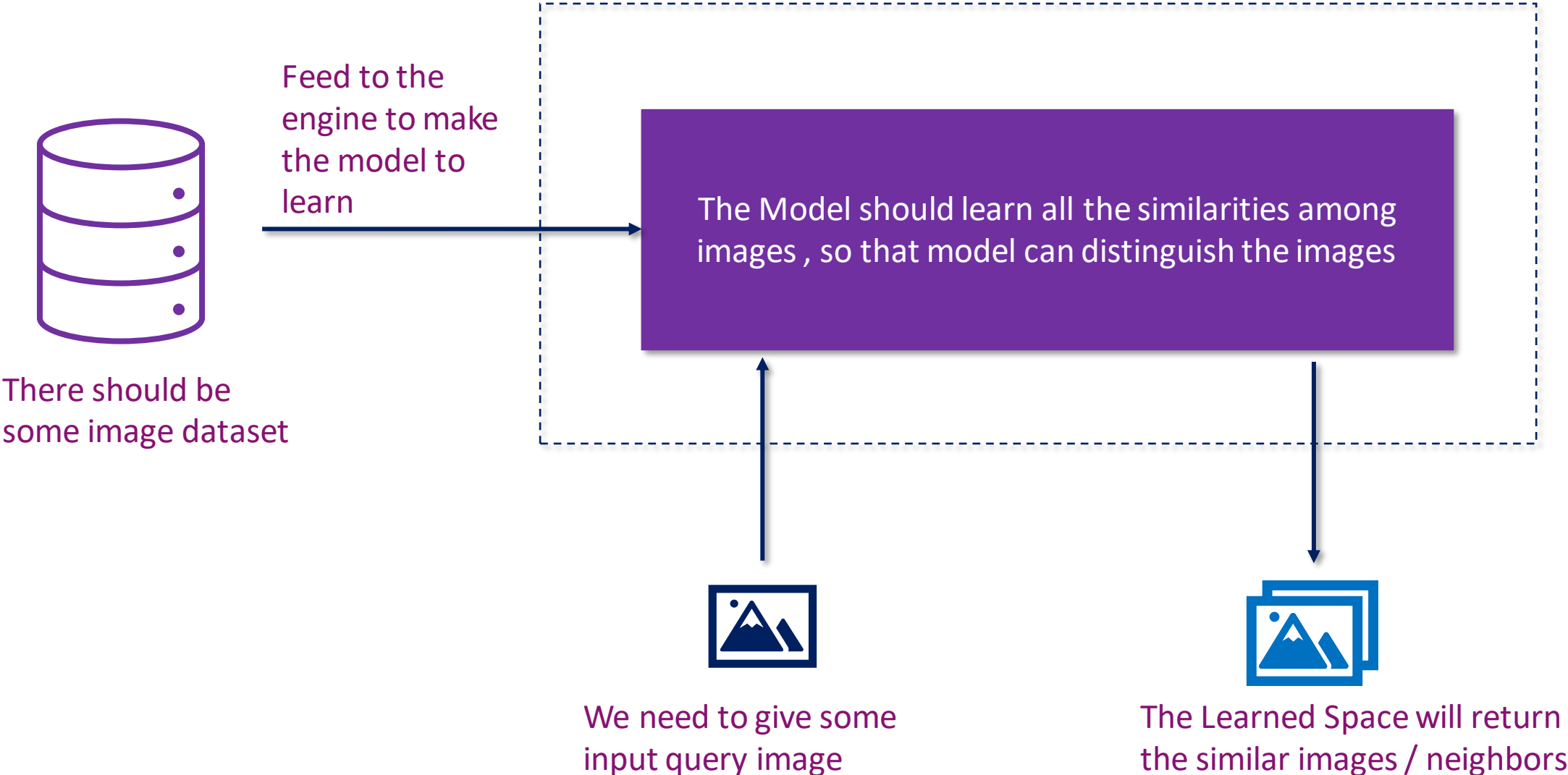
Given Image:

Results:

Pinterest / Flicker Visual search uses ML based information retrieval for Content based search / reverse search / recommendation systems

What makes them to understand?
Let's try to build something like this!
Not exactly – but fundamental one!

Let's Imagine – Image Similarity search engine

What's under the hood of this learning space???

Feed to the engine to make the model to learn

The Model should learn all the similarities among images , so that model can distinguish the images

There should be some image dataset

We need to give some input query image

The Learned Space will return the similar images / neighbors

Architectural Diagram:

Metric Based Meta Learning Environment

Image Dataset

Anchor Dataset

Positive Dataset

Siamese Network

Similarity and contrastive loss

Metric based Embedding space

Query Image

Similarity based Ranked images

Lot of New words?? – Let's Learn from the basic!
1. Meta Learning
2. Metric Learning
3. Embeddings
4. Similarity – Distance metric

What is Metric Based Meta Learning?:

Metric Based + Meta Learning

Type of Meta Learning

Learning to Learn

We always want to learn New skills (c++)

It becomes easier, if we already learned some skills (python) – Easy to adapt

We want to design models which can learn to generalize well to new tasks (unseen – but relatable), data or environments which are different from the ones in training

The aim of meta-learning is to learn to generalize well on multiple tasks with little data.
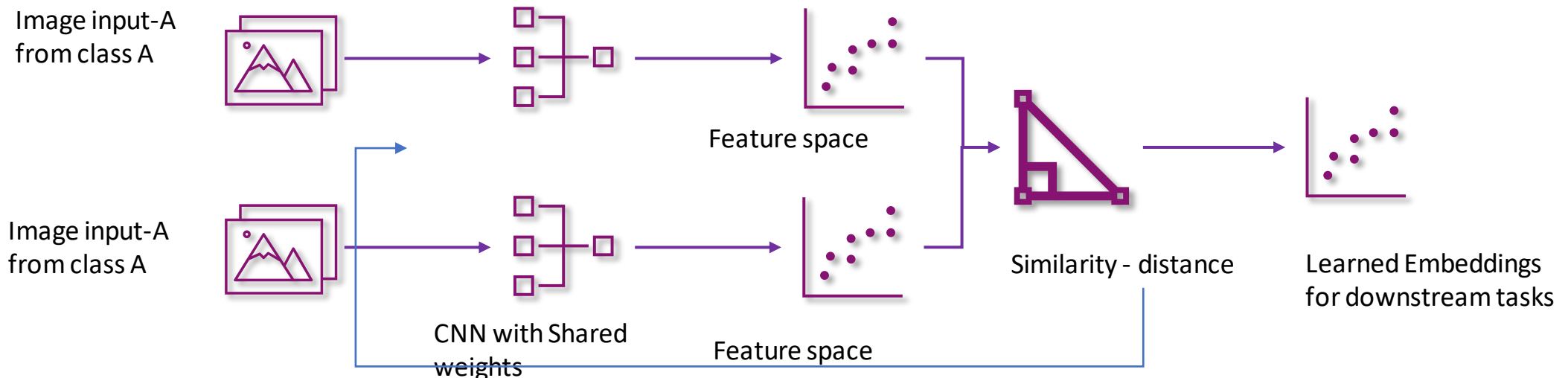
Three Major Types of Meta Learning : 1. Metric Based 2. Model Based 3. Optimization Based
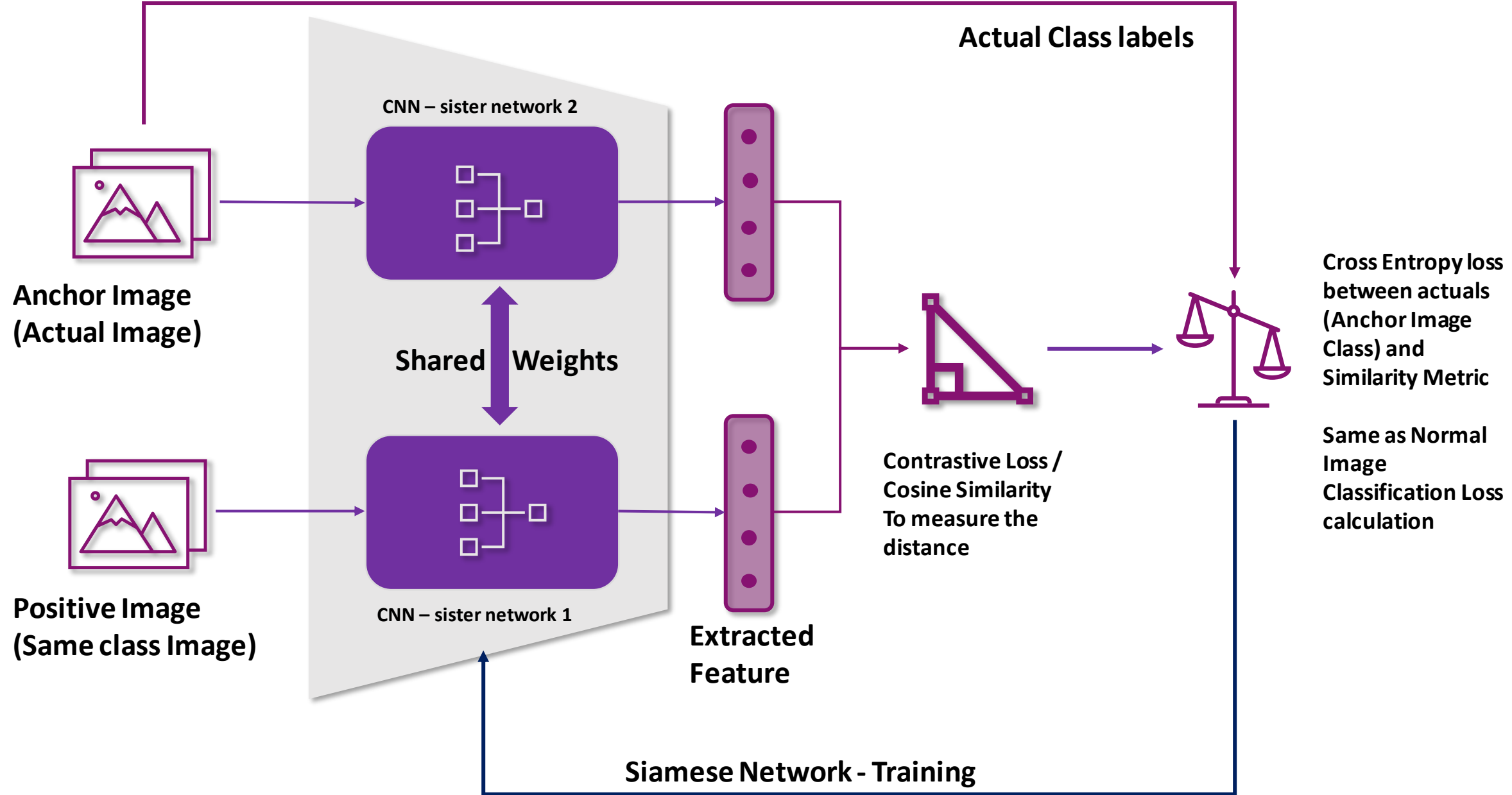
Let's Deep Dive into Metric Learning !

Metric → Performance measure → Distance between Data points → Cosine Similarity

Do you remember picture pixel-by-pixel?
- No. To learn, we need to extract the maximum information we care with the least amount of memory.
- So, the metric-learning approach focuses on how well we extract features but not overdo it
- Learning is driven by Distance function , Not just Loss function
- In general, **Metric-Learning** algorithms learn to compare data samples.
- In the case of a **Few-Shot** classification problem, they classify query samples based on their similarity to the support samples.
- Support set → Used in training ; Query set → Used in Evaluation

Image input-A from class A

Image input-A from class A

Feature space

Feature space

CNN with Shared weights

Similarity - distance

Learned Embeddings for downstream tasks

Siamese Networks – The real robin hood here!

Actual Class labels

Anchor Image
(Actual Image)

CNN – sister network 2

Shared Weights

CNN – sister network 1

Positive Image
(Same class Image)

Extracted Feature

Contrastive Loss / Cosine Similarity To measure the distance

Cross Entropy loss between actuals (Anchor Image Class) and Similarity Metric

Same as Normal Image Classification Loss calculation

Siamese Network - Training

What is the distance metric being learnt here?

Questions

Thanks for Attending

Appendix

What is Metric Based Meta Learning?:

- A Siamese Neural Network is a class of neural network architectures that **contain two or more *identical* subnetworks**. '*identical*' here means, they have the same configuration with the same parameters and weights.
- Parameter updating is mirrored across both sub-networks. It is used to find the similarity of the inputs by comparing its feature vectors, so these networks are used in many applications

What is Metric Based Meta Learning?:

Siamese