

What is Transfer Learning and Finetuning?

Monday, April 28, 2025 4:04 PM

- "Transfer learning means taking experience from one problem and using it to solve another related problem."

Real Life Example: "It's like learning to ride a bicycle and then using that skill to learn how to ride a motorcycle faster."

Computer Scientist took this simple idea and integrated into the deep learning.

ILSVRC (ImageNet Large Scale Visual Recognition Challenge) version mein:

- Training Images: ~1.2 million
- Validation Images: 50,000
- Test Images: 100,000 (labels hidden, competition ke liye)
- Classes: 1000 (dog, cat, car, airplane, etc.)
- Full ImageNet Dataset (original, jo Stanford maintain karta hai):
 - 14M+ million images
 - 21,841 categories (WordNet synsets ke hisaab se)

This is example of those 1000 classes

Cat
Dog
Vehicle
Aircraft
Bird
Fruit
Vehicle
Sports Object
Musical Instrument
Humans

ImageNet

Now suppose your specific class is not included among the 1000 classes available in the ImageNet dataset.



Now the ways of doing this Transfer Learning:

In CNN based Architecture:

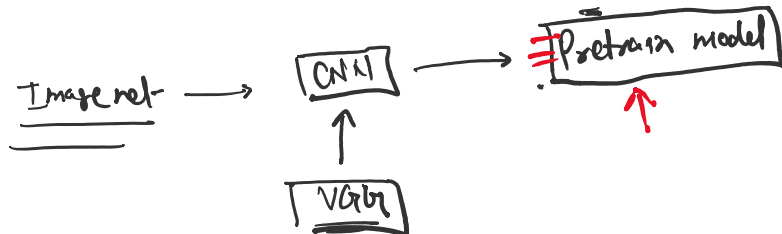
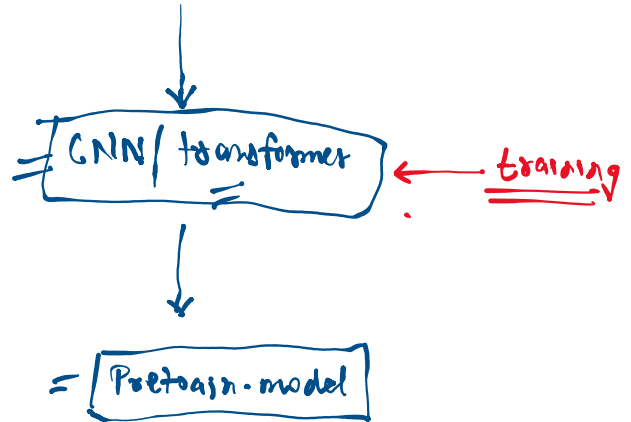
- Replacing the output layer of pretrain model
- Or don't change weights means keep freezing all the weights just retrain the Neural Network Weights
- Or unfreezing some layers of the network and fine-tuning it on the new, task-specific dataset

Now Lets take a very simple example:

First understand it using the CNN based Architecture.

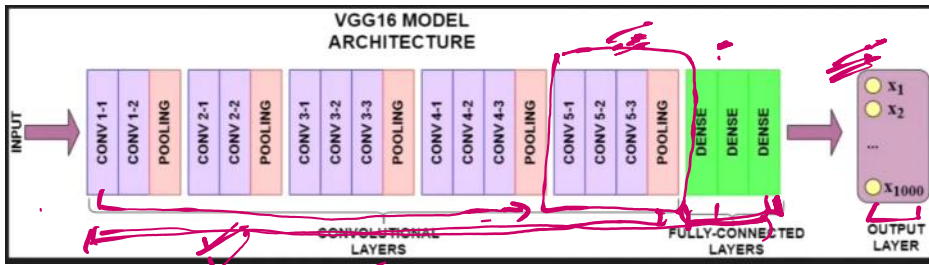
VGG16 MODEL
ARCHITECTURE

huge amt of data



Rahul Sharma

First understand it using the CNN based Architecture.



Why this transfer learning works

We train a model on a **huge dataset** initially, allowing it to learn **primitive features** (like edges, textures, and simple shapes).
When applying it to a **different dataset**, we don't retrain the entire model — we only retrain certain layers if the new data is **very different**.
Otherwise, we can directly reuse the model's knowledge.

(Pretrain) → (Transfer learn) = FT Model

Act Pin
L. binary → Sigmoid
L. multi → Softmax

Specific
more car eyes lips

Transfer Learning in Generative AI (Using LLMs)

In Transformer based Architecture:

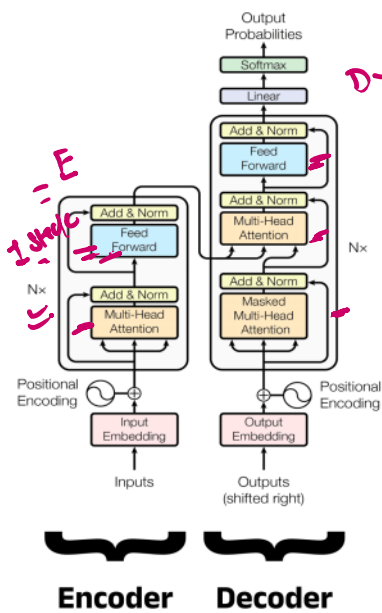
- Replacing the **output layer** of pretrain model
- Or **unfreezing some layers** of the network and **fine-tuning** it on the new, task-specific dataset

huge PEFT
GPT 3.5, 4, 4V

Transformer

GPT*

BERT*

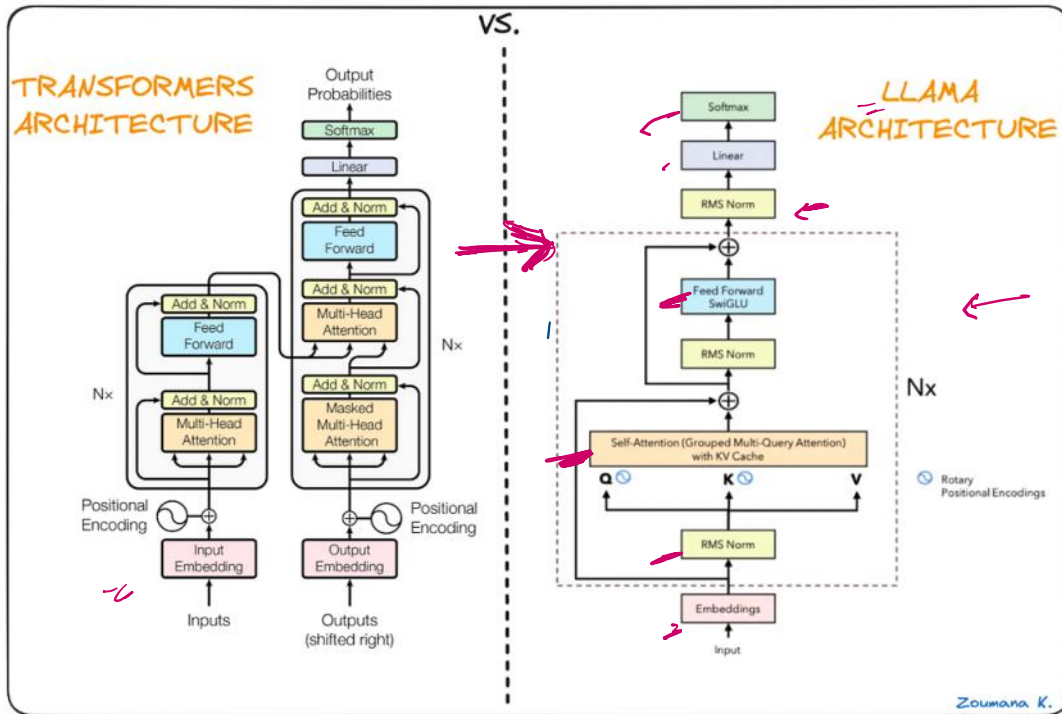


Decoder-only

Encoder-only

12
24
24 = 12 + 12

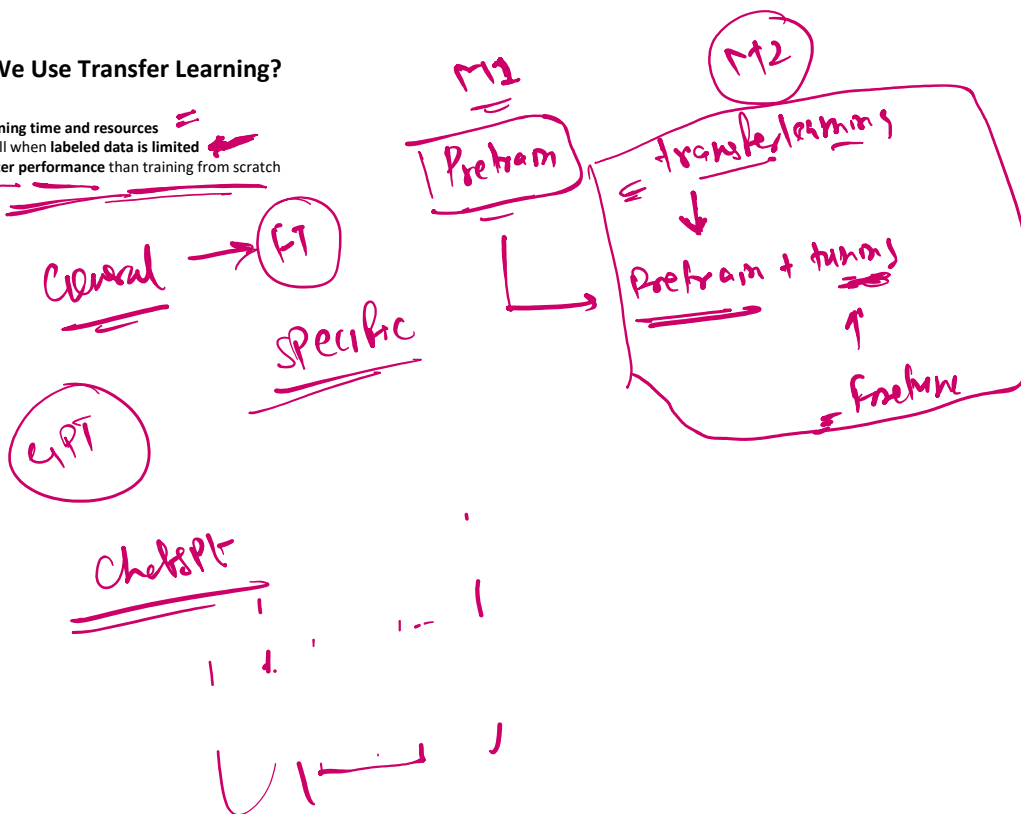
*Illustrative example, exact model architecture may vary slightly



BIT
PEFT
SUBSET
Quantized

Why Do We Use Transfer Learning?

- Saves training time and resources
- Works well when labeled data is limited
- Gives better performance than training from scratch



CNN Finetuning

Wednesday, April 23, 2025 6:54 PM

Correct: <https://colab.research.google.com/drive/1Dtipjnr4WXnl8ErDeNzzOjzGtgmV-F4r?usp=sharing>

<https://colab.research.google.com/drive/1U57ZndGQ6WnPdtM2rTdxPARNnTsfRds7?usp=sharing>

Bert Finetuning

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<https://colab.research.google.com/drive/1Dtipjnr4WXnl8ErDeNzzOjzGtgmV-F4r?usp=sharing>

<https://colab.research.google.com/drive/1U57ZndGQ6WnPdtM2rTdxPARNnTsfRds7?usp=sharing>