**Parameter-Efficient Finetuning (PEFT):**

PEFT approaches only fine-tune a small number of (extra) model parameters while freezing most parameters of the pretrained LLMs, thereby greatly decreasing the computational and storage costs. It Improve the performance of a pre-trained model on a specific task with limited data and computation

Benefits of PEFT:

1. Cost effective

2. Less training time.

3. Less storage space .

4. Better modelling performance as overfitting is reduced.

5. Works with smaller GPUs and memory

**Types of PEFT:**

**A-Lora (**Low Rank Adaption LLM)

It involves freezing the pre-trained model weights and injecting trainable rank decomposition matrices into each layer of the transformer architecture which reduces number of trainable parameters .

**B-Adapters :**

This module is added to the existing pretrained model . By inserting adapters after the multi-head attention and feed-forward layers in the transformer architecture, we can update only the parameters in the adapters during fine-tuning while keeping the rest of the model parameters frozen.

**C-Prefix Tuning:**

Prefix-tuning keeps the language model parameters frozen and optimizes a small continuous task-specific vector called the prefix. In prefix-tuning, the prefix is a set of free parameters that are trained along with the language model. The goal of prefix-tuning is to find a context that steers the language model toward generating text that solves a particular task

**D-Prompt Tuning:**

Prompt tuning involves learning soft prompts through backpropagation that can be fine-tuned for specific tasks by incorporating labelled examples. Ex: Few short learning

**4 -Reinforcement Learning with Human Feedback (RLHF):**

In this approach a LLM is finetuned using both supervised learning and reinforcement learning. It allows LLM to learn from human preferences. With the combination of reinforcement learning and human feedback, RLHF can efficiently train LLMs with less labelled data and improve their performance on specific tasks. Therefore, RLHF is a powerful framework for enhancing the capabilities of LLMs and improving their ability to understand and generate natural language.