



COPS Summer of Code 2025

Intelligence Guild

Club Of Programmers, IIT (BHU) Varanasi

Artificial Neural Networks

20 – 29 May 2025

Official IG Website: <https://cops-iitbhu.github.io/IG-website/>

All deadlines are strict. No extensions will be granted.

Introduction

COPS Summer of Code (CSOC) is a flagship initiative under the Club Of Programmers, IIT (BHU) Varanasi, with all verticals contributing through focused tracks. This document outlines the prerequisites for the Intelligence Guild vertical.

Modules will be released weekly and from time to time. **Adhere strictly to deadlines.** Submissions will be evaluated on approach, technical correctness, and clarity. The most technically accurate solution may not necessarily be the one chosen; clarity of thought and a well-reasoned approach will be valued more.

Communities

All communication for the programme will be conducted strictly via [Discord](#). Do not reach out through other channels. Resources and updates will be posted on [Github](#), and all notifications will be made via Discord.

Final Report

A concise report may be submitted along with your final assignment. While **not mandatory**, it may strengthen your overall evaluation. Reports must be written in \LaTeX and submitted in PDF format only. We are not interested in surface-level descriptions — focus strictly on your analysis, approach, and reasoning. The report itself constitutes the final assignment. No additional files are to be submitted. Refer to the Assignment section for details.

Contact Details

In case of any doubts, clarifications, or guidance, you can contact one of us. We request that you stick to Discord as the preferred mode of communication for all the questions that you have as it will also benefit others. However, you can reach out to us through other means in case we fail to respond on Discord.

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Resources

In this module we will learn the heart of machine learning: **Artificial Neural Network**. This module will be your launchpad into the fascinating world of deep learning, where simple units connect to solve complex problems.

Just a quick note before we jump into the resources, don't feel restricted to only these! If any topic feels unclear or if you're curious to explore further (which we highly recommend if you have the time), feel free to consult additional resources. These are simply the ones we found helpful and worth sharing.

Theory:

- If you're looking to truly understand what's happening inside a neural network and not just code it, this is the perfect place to start. [3Blue1Brown Neural Networks video](#) explains core concepts very well.
- This playlist by [Sir Mitesh Khapra](#) is great for understanding neural network's maths. It starts from basics and goes all the way deep into neural networks. Consider watching Lec 2.1 to 4.9, they cover the fundamentals of neural nets.
- If you still don't understand Backpropagation, then we would recommend watching this [video](#).
- If needed: [Derivation of the Gradient of the cross-entropy Loss](#)
- [How is the gradient calculated for the middle layer's weights?](#)
- [Vanishing and Exploding Gradients in Deep Neural Networks](#)

Coding

Now that you've built a solid theoretical understanding of neural networks, it's time to bring that knowledge to life with code.

This section will guide you through implementing what you've learned.

- This [playlist by Sentdex](#) offers a practical introduction to neural network implementation, walking you through the coding process step by step.
- This [book](#) by sentdex also includes the process to code neural network.

Frameworks

Once you're comfortable with the fundamentals and have built a basic neural network from scratch, it's time to level up. This is where deep learning frameworks come in powerful tools like TensorFlow, PyTorch, and Keras that simplify model building, training, and deployment. They let you focus more on experimenting and less on reinventing the wheel, making your journey faster, more scalable, and production-ready.

Although we'll be focusing on PyTorch in this module

To get hands-on with PyTorch, here are two excellent playlists to choose from:

- [PyTorch for Deep Learning](#): Videos 1-2
- [Deep Learning with PyTorch: Zero to GANs](#): Videos 1-13

Here is a [blog](#), to get you familiar with PyTorch.

Additional Resources:

- [Vanishing Gradient Problem in ANN](#)
- [Early Stopping](#)
- [Dropout layers](#)
- [Feature Scaling Batch Normalization](#)
- [Different type of optimisers: lec 5.1 to 5.9\(if you have spare time\)](#)

Project Tasks



The official task for this module will be shared soon. In the meantime go through the listed resources and make sure you understand both the theory and implementation of neural networks.

Adios, and keep learning!