Introduction to Neural Networks Inspiration from Nature Birds inspired humans to

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Introduction to Neural Networks Inspiration from Nature Birds inspired humans to build airplanes. The tiny hooks on burrs sticking to a dog’s fur led to the invention of Velcro. And just like that, nature has always been humanity’s greatest engineer. So, when it came to making machines that could think, learn, and solve problems, where did we look? To the human brain. That’s how neural networks were born — machines inspired by neurons in our brains, built to recognize patterns, make decisions, and even learn from experience.

Core Concepts

What is AI, ML, and DL? Before we dive into neural networks, let’s untangle these buzzwords. Term Stands for Think of it as… AI Artificial Intelligence The big umbrella: making machines “smart” ML Machine Learning A subset of AI: machines that learn from data DL Deep Learning A type of ML: uses neural networks Let’s simplify: AI is the dream: “Can we make machines intelligent?” ML is the method: “Let’s give machines data and let them learn.” DL is the tool: “Let’s use neural networks that learn in layers — like the brain.” • • • So, when we talk about neural networks, we’re entering the world of deep learning, which is a part of machine learning, which itself is a part of AI. So, What Are Neural Networks? Imagine a bunch of simple decision-makers called neurons, connected together in layers. Each neuron: Takes some input (like a number) Applies a little math (weights + bias) Passes the result through a rule (called an activation function) Sends the output to the next layer By connecting many of these neurons, we get a neural network.

Key Ideas

And what’s amazing? Even though each neuron is simple, when combined, the network becomes powerful — like how a bunch of ants can build a complex colony. Why Are Neural Networks Useful? Because they can learn patterns, even when we don’t fully understand the patterns ourselves. Examples: Recognize cats in photos Convert speech to text Translate languages Predict stock prices Generate art Power AI like ChatGPT • • • • • • • • • • Structure of a Neural Network Here’s the basic anatomy of a neural network: Each layer is just a bunch of neurons working together. The more hidden layers, the “deeper” the network.

Detailed Explanation

Hence: Deep Learning. Wait — Why Not Use Simple Code Instead? Good question. Sometimes, a simple formula or rule is enough (like area = length × width). But what about: Recognizing handwritten digits? Understanding language?

Important Points

Diagnosing diseases from X-rays? There are no easy formulas for these. Neural networks learn the

formula by themselves from lots of examples. How Do Neural Networks Learn? Let’s say the network tries to predict $y = x^2 + x$. It starts with random guesses (bad predictions) It checks how wrong it is (loss) It adjusts the internal settings (weights) to be a little better Repeat, repeat, repeat… Input Layer !’ Hidden Layers !’ Output Layer (Data) (Neurons doing math) (Predicti