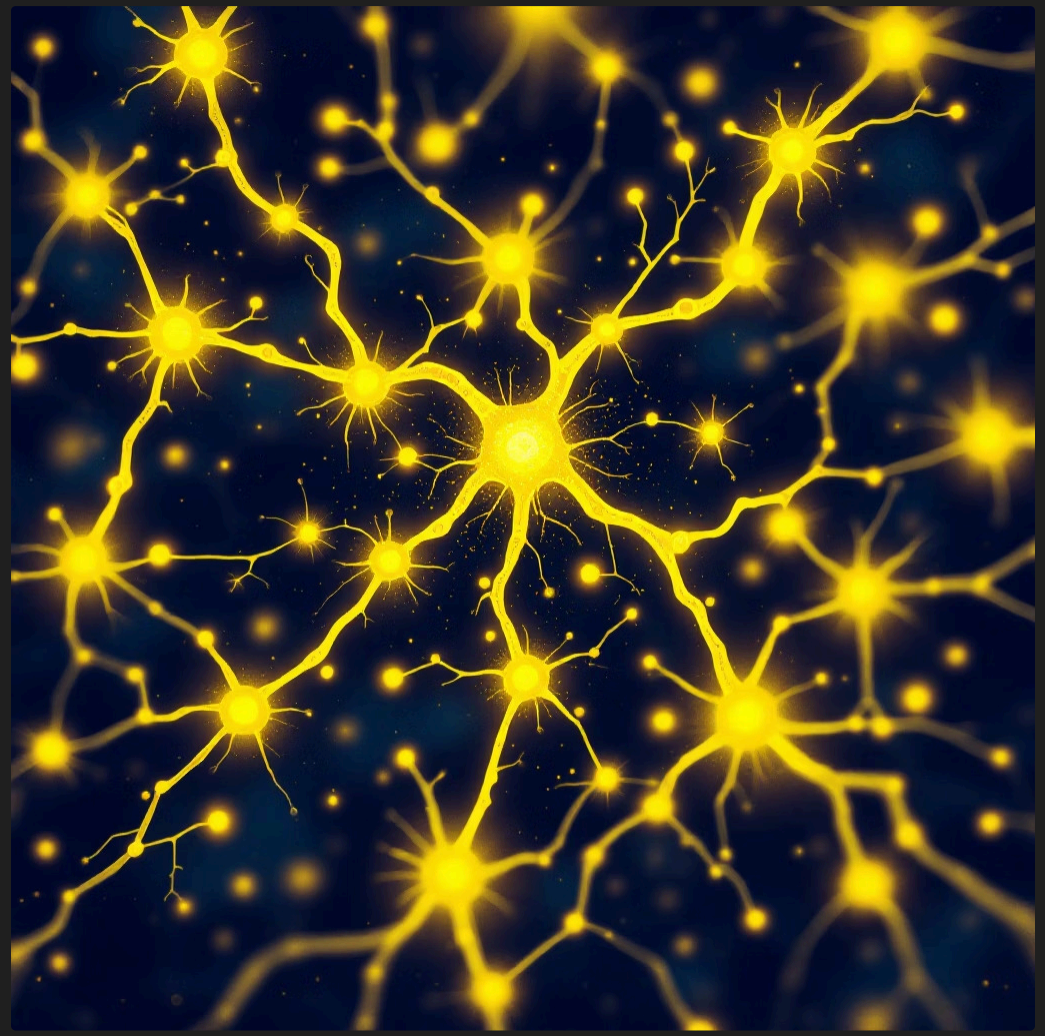
Introduction to Neural Networks

A gentle start to Artificial Intelligence — exploring how machines learn to think like humans

What Is a Neural Network?



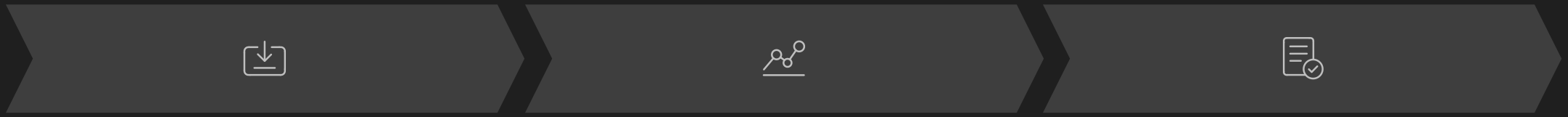
Learning from Nature

Neural networks are inspired by the human brain, mimicking how our neurons communicate and process information.

Instead of following rigid rules, these networks **learn from examples** — just like how a child learns to recognize a cat by seeing many different cats.

Each artificial neuron connects to others, passing signals and adjusting its connections to improve over time.

The Basic Idea



Input

Raw data enters — images, sounds, or numbers

Hidden Layers

Information flows through layers that detect patterns

Output

Final prediction or decision emerges

Think of it as a **relay race** — each layer refines the information a bit more, passing it forward until we reach an accurate answer. The network learns by adjusting the strength of connections between neurons, tuning itself like a musical instrument until everything works in harmony.

Step 1: The Input Layer

Images

Photos become grids of pixel brightness values

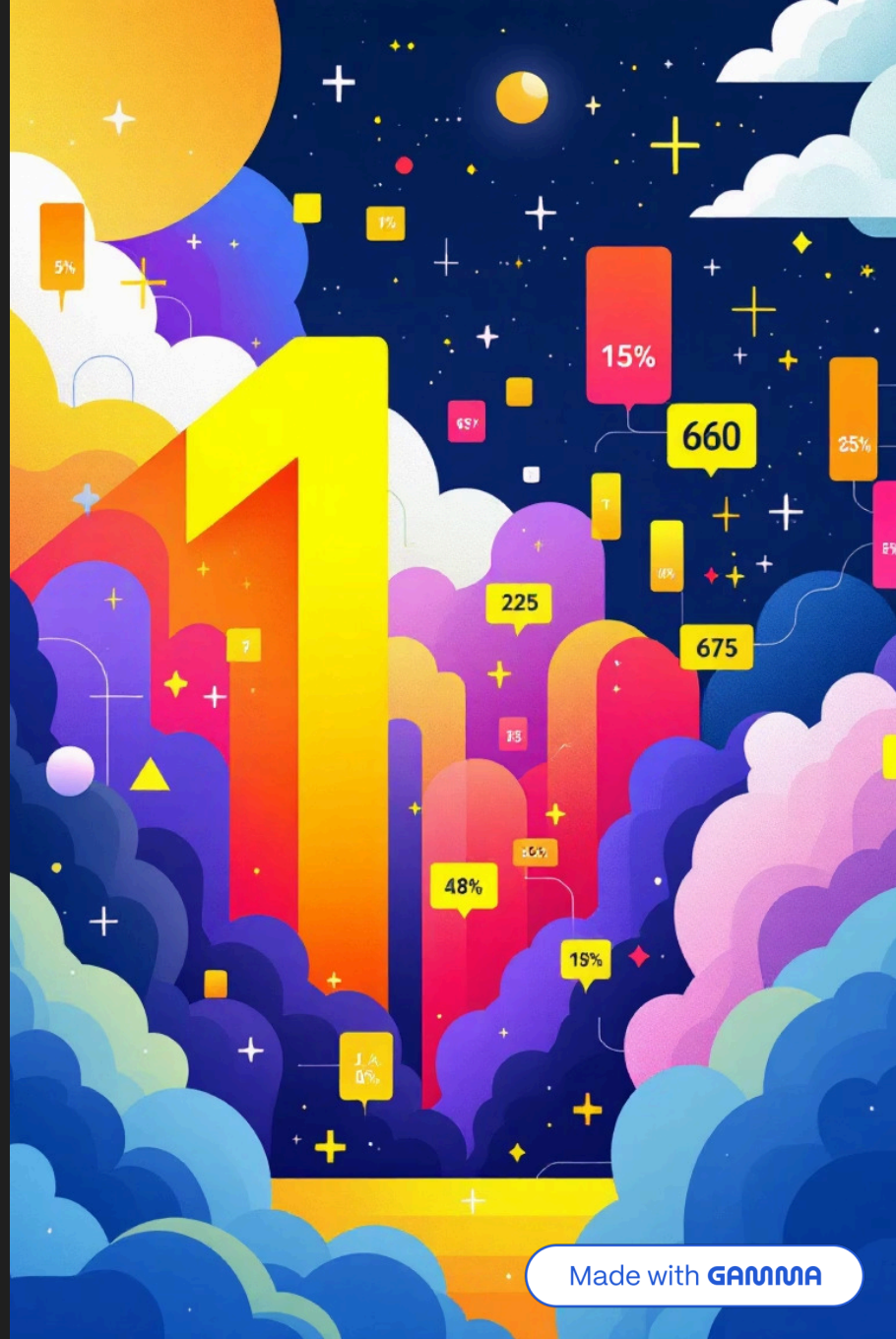
Sounds

Audio transforms into wave amplitude numbers

Text

Words convert to numerical vectors

Everything must be translated into numbers — the language computers understand. A cat photo? Thousands of numbers representing color and brightness. A voice? Numbers capturing sound patterns over time.



Step 2: Hidden Layers — Where Magic Happens

Pattern Recognition

Each neuron combines inputs using weights — numbers that determine importance. After combining, an activation function decides if the signal should pass forward.

Early layers spot simple features like edges or frequencies. Deeper layers combine these into complex patterns — shapes, objects, even abstract concepts.

Example: In a cat photo, first layers detect edges, next ones notice curved shapes, and deep layers recognize "whiskers and ears — must be a cat!"

Step 3: The Output Layer

90%	8%	2%
Cat	Dog	Rabbit
Highest confidence	Lower probability	Minimal chance

The output layer acts as the **decision-maker**, taking all insights from hidden layers and expressing them as a clear answer. Each neuron represents a possible conclusion, and the highest value wins — delivering the network's final prediction with confidence.

How Neural Networks Learn

01

Random Start

Weights begin as random numbers — predictions are just guesses

02

Compare & Measure

Check predictions against correct answers to calculate error

03

Adjust Weights

Use backpropagation to fine-tune connections and reduce mistakes

04

Repeat & Improve

Train through thousands of iterations until predictions become accurate

Like learning to throw darts blindfolded — each miss teaches you to adjust. With practice, you hit the bullseye more often. Neural networks learn the same way: trial, error, and adjustment.

Making Decisions

Pattern Recognition Engine

A trained network has built an internal map of patterns. When it sees new data, it searches for familiar features learned during training.

Important: The network doesn't truly "understand" like humans do. It finds correlations — statistical patterns in numbers. No consciousness, no emotion — just incredibly accurate pattern matching.

This allows **generalization** — making smart predictions on completely new data it's never encountered before.

Real-World Examples

Voice Assistants

Alexa and Siri convert speech to numbers, recognize patterns, and understand your requests

Image Recognition

Google Photos automatically identifies faces, objects, and moments in your pictures

Self-Driving Cars

Process camera and sensor data to navigate safely, recognizing pedestrians and signs

Spam Detection

Automatically filters suspicious emails by learning patterns of fraudulent messages

Medical Diagnosis

Helps doctors spot tumors and diseases in X-rays and MRIs with expert precision

What's Next?

> *"Today we built intuition — next time, we'll build understanding."*

Our Next Deep Dive

1

Neuron Structure

Mathematical details of how neurons process signals using inputs, weights, and activation functions

2

Training Process

Step-by-step exploration of backpropagation and optimization techniques

3

Types of Networks

Convolutional networks for images, recurrent networks for sequences, and specialized architectures

Today you learned how machines learn to think. Next session, we'll peek under the hood and see the engine that powers AI — ready to build your own neural network!