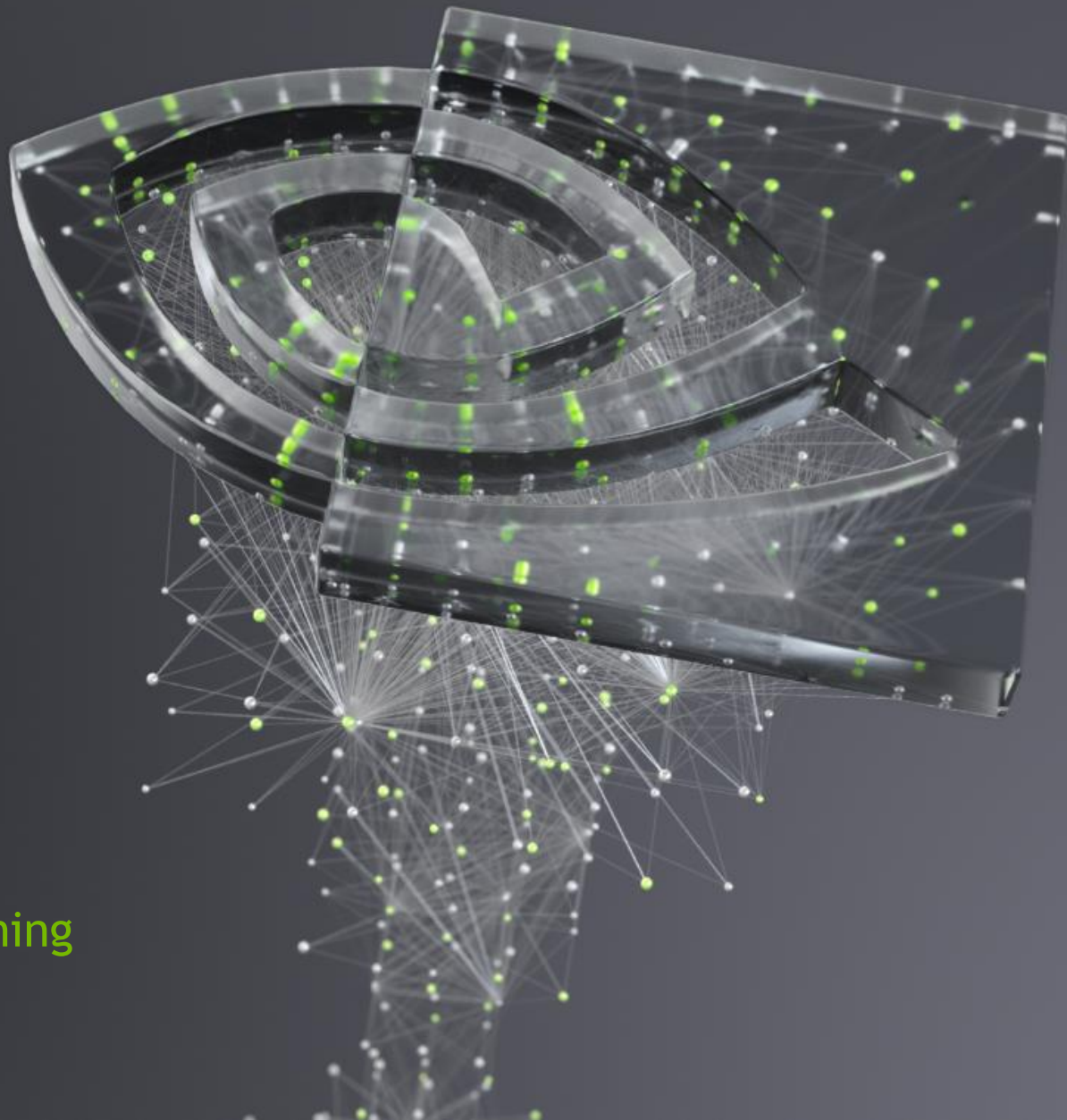


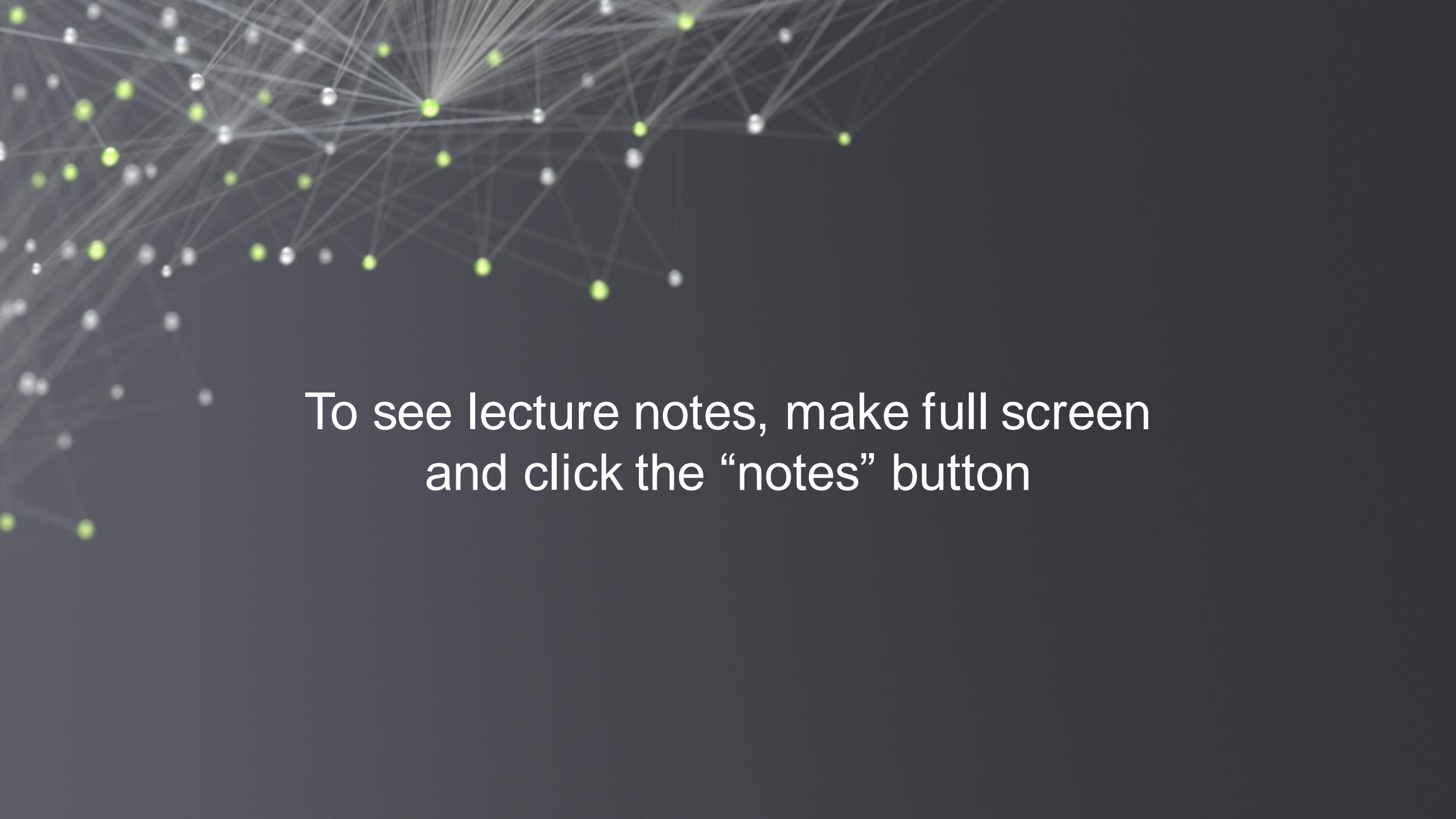


DEEP
LEARNING
INSTITUTE

FUNDAMENTALS OF DEEP LEARNING

Part 1: An Introduction to Deep Learning





To see lecture notes, make full screen
and click the “notes” button



WELCOME!

THE GOALS OF THIS COURSE

- Get you up and on your feet quickly
- Build a foundation to tackle a deep learning project right away
- We won't cover the whole field, but we'll get a great head start
- Foundation from which to read articles, follow tutorials, take further classes

AGENDA

Part 1: An Introduction to Deep Learning

Part 2: How a Neural Network Trains

Part 3: Convolutional Neural Networks

Part 4: Data Augmentation and Deployment

Part 5: Pre-trained Models

Part 6: Advanced Architectures

AGENDA – PART I

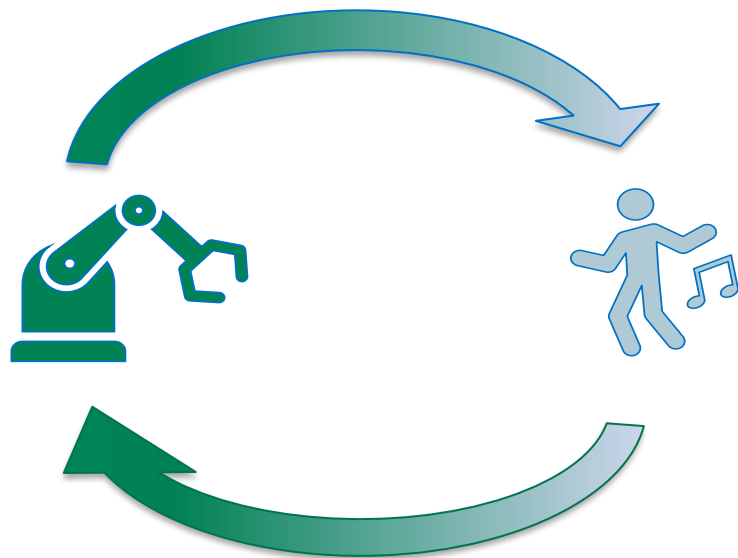
- History of AI
- The Deep Learning Revolution
- What is Deep Learning
- How Deep Learning is Transforming the World
- Overview of the Course
- First Exercise



HAVE FUN!

HUMAN VS MACHINE LEARNING

Relaxed Alertness



Human	Machine
Rest and Digest	Training
Fight-or-flight	Prediction



LET'S GET STARTED



HISTORY OF AI

BEGINNING OF ARTIFICIAL INTELLIGENCE



COMPUTERS ARE MADE IN
PART TO COMPLETE HUMAN
TASKS

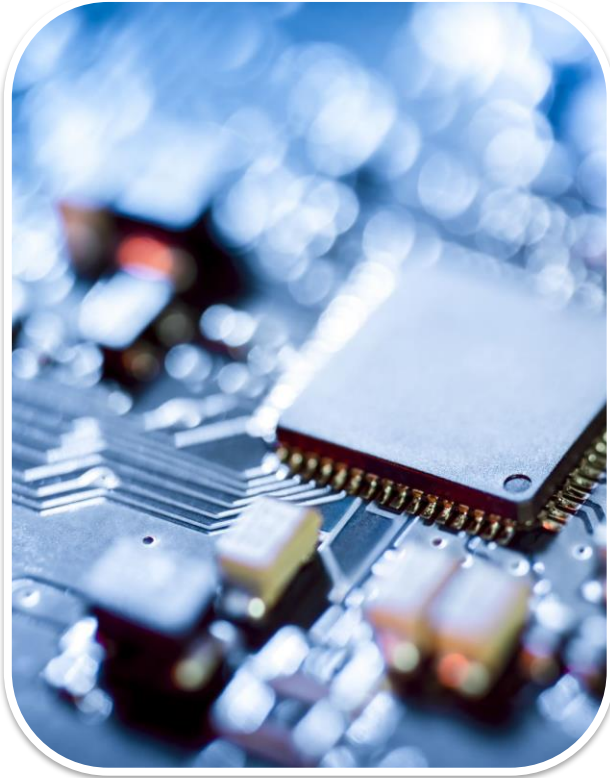


EARLY ON, GENERALIZED
INTELLIGENCE LOOKED
POSSIBLE



TURNED OUT TO BE HARDER
THAN EXPECTED

EARLY NEURAL NETWORKS



Inspired by biology

Created in the 1950's

Outclassed by Von
Neumann Architecture

EXPERT SYSTEMS



Highly complex



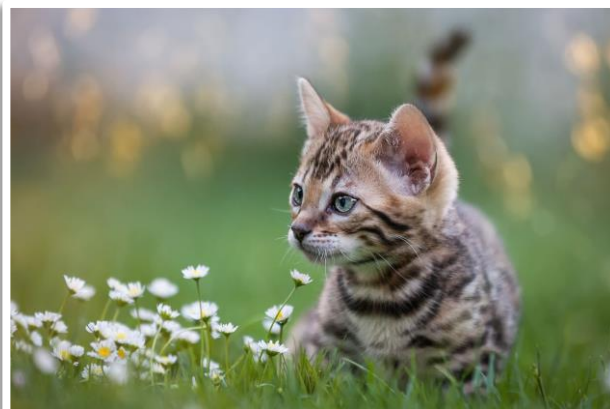
Programmed by hundreds of engineers



Rigorous programming of many rules

EXPERT SYSTEMS - LIMITATIONS

What are these three images?



HOW DO CHILDREN LEARN?



- Expose them to lots of data
- Give them the “correct answer”
- They will pick up the important patterns on their own



THE DEEP LEARNING REVOLUTION

DATA

- Networks need a lot of information to learn from
- The digital era and the internet has supplied that data



COMPUTING POWER

Need a way for our artificial “brain” to observe lots of data within a practical amount of time.

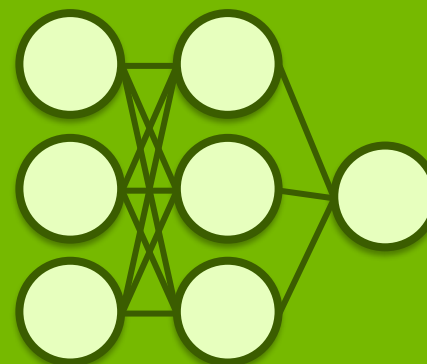


THE IMPORTANCE OF THE GPU

A Rendered Image



A Neural Network





WHAT IS DEEP LEARNING?



DEEP LEARNING FLIPS TRADITIONAL PROGRAMMING ON ITS HEAD

TRADITIONAL PROGRAMMING

Building a Classifier

1

Define a set of
rules for
classification

2

Program those
rules into the
computer

3

Feed it examples,
and the program
uses the rules to
classify

MACHINE LEARNING

Building a Classifier

1

Show model the examples with the answer of how to classify

2

Model takes guesses, we tell it if it's right or not

3

Model learns to correctly categorize as it's training. The system learns the rules on its own



THIS IS A FUNDAMENTAL SHIFT

WHEN TO CHOOSE DEEP LEARNING

Classic Programming

If rules are clear
and
straightforward,
often better to just
program it

Deep Learning

If rules are
nuanced, complex,
difficult to discern,
use deep learning

DEEP LEARNING COMPARED TO OTHER AI

Depth and complexity of networks

Up to billions of parameters (and growing)

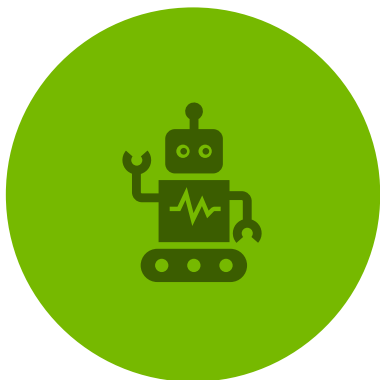
Many layers in a model

Important for learning complex rules



HOW DEEP LEARNING IS
TRANSFORMING THE WORLD

COMPUTER VISION



ROBOTICS AND
MANUFACTURING



OBJECT
DETECTION



SELF DRIVING
CARS

NATURAL LANGUAGE PROCESSING



REAL TIME
TRANSLATION



VOICE
RECOGNITION



VIRTUAL
ASSISTANTS

RECOMMENDER SYSTEMS



CONTENT
CURATION



TARGETED
ADVERTISING



SHOPPING
RECOMMENDATIONS

REINFORCEMENT LEARNING



ALPHAGO BEATS
WORLD CHAMPION
IN GO



AI BOTS BEAT
PROFESSIONAL
VIDEOGAMERS



STOCK TRADING
ROBOTS



OVERVIEW OF THE COURSE

HANDS ON EXERCISES

- Get comfortable with the process of deep learning
- Exposure to different models and datatypes
- Get a jump-start to tackle your own projects



STRUCTURE OF THE COURSE

“Hello World” of Deep Learning



```
graph TD; A["“Hello World” of Deep Learning"] --> B["Train a more complicated model"]; B --> C["New architectures and techniques to improve performance"]; C --> D["Pre-trained models"]; D --> E["Transfer learning"];
```

Train a more complicated model

New architectures and techniques to improve performance

Pre-trained models

Transfer learning

PLATFORM OF THE COURSE



GPU powered cloud server



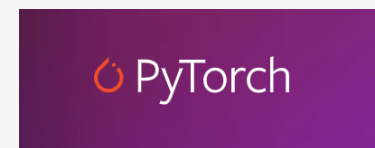
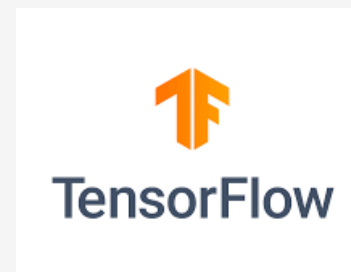
JupyterLab platform



Jupyter notebooks for interactive coding

SOFTWARE OF THE COURSE

- Major deep learning platforms:
 - TensorFlow + Keras (Google)
 - Pytorch (Facebook)
 - MXNet (Apache)
- We'll be using TensorFlow and Keras
- Good idea to gain exposure to others moving forward





FIRST EXERCISE: CLASSIFY HANDWRITTEN DIGITS

HELLO NEURAL NETWORKS

Train a network to
correctly classify
handwritten digits

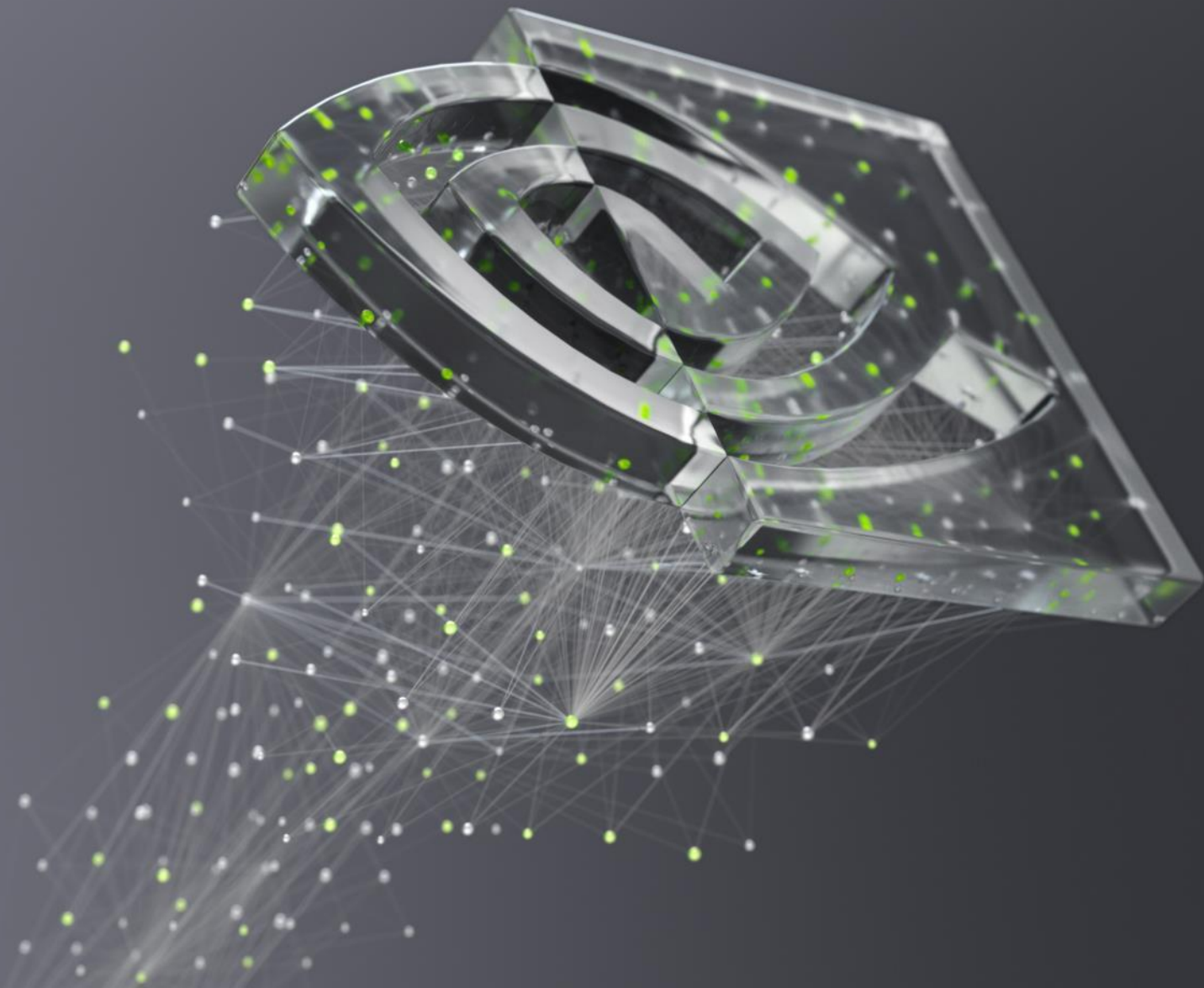
- Historically important and difficult task for computers

Try learning like a
Neural Network

- Get exposed to the example, and try to figure out the rules to how it works



LET'S GO!



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