

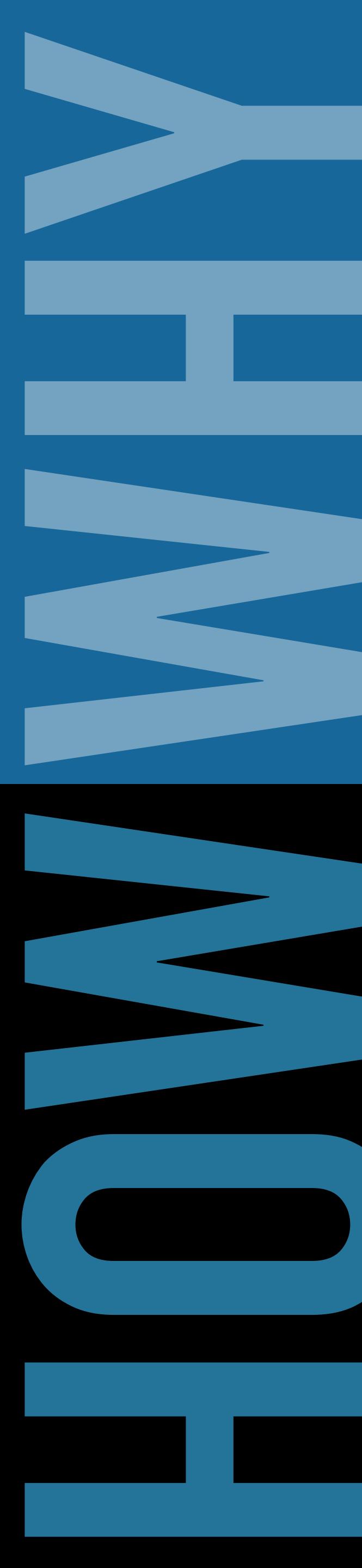


# DEEP LEARNING IN JAVASCRIPT

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# ASK WHAT AI CAN DO FOR YOU

Kevin Scott | 5.17.19

- 
1. Why Deep Learning Matters
  2. Edge Intelligence
  3. A Simple Neural Network
  4. Transfer Learning for Images

- 
- ▶ Designer & Developer
  - ▶ Software Consultant
  - ▶ Laser Aficionado

@thekevinscott



# DEEP LEARNING IN JAVASCRIPT

## A Hacker's Guide To Getting Started With Neural Networks

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### Foreword

```
function login(username, password) {
  const user = User.get(username)
  if (!user) {
    throw new Error('Bad login attempt')
  } else if (!user.checkPassword(password)) {
    throw new Error('Bad login attempt')
  } else if (user.expired) {
    throw new Error('Your subscription has expired')
  }
  return user
}
```

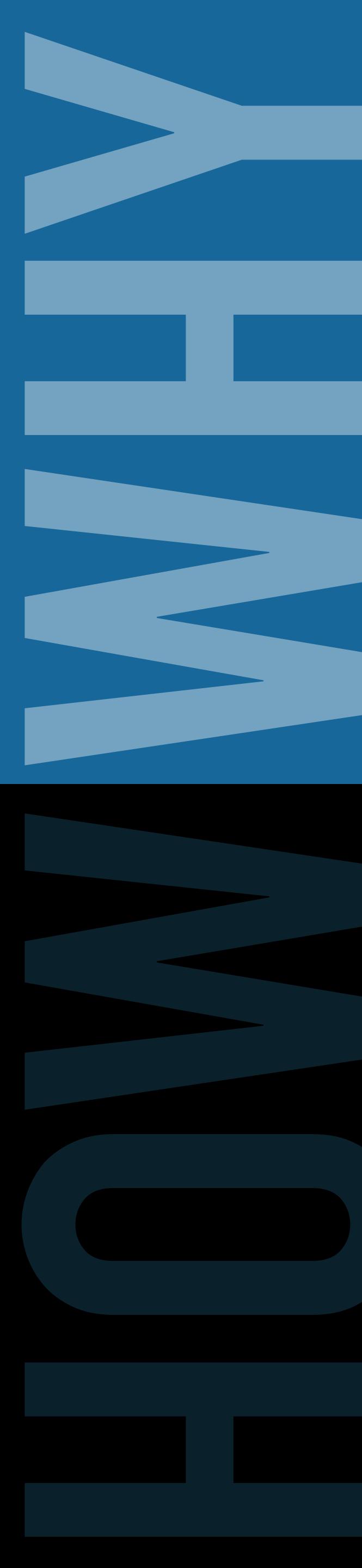
You've probably seen code like this before.

This is how most software gets written today. Manually and line by line. You, the programmer, specify everything about how a program should operate, from how a user interacts to the way data is stored and retrieved.

Some have called this approach to code [explicit programming](#), though a more straight forward description would simply be "programming".

When you're building a login form, or any sort of system where you want this action to cause that outcome, explicitly programming software makes a lot of sense. You can reason through code like this. There's little danger that the software wakes up one day on the wrong side of the bed and decides it's tired of this whole "login business" and why don't we try logging users *out* for a change? Your code will always do exactly what you've told it to.



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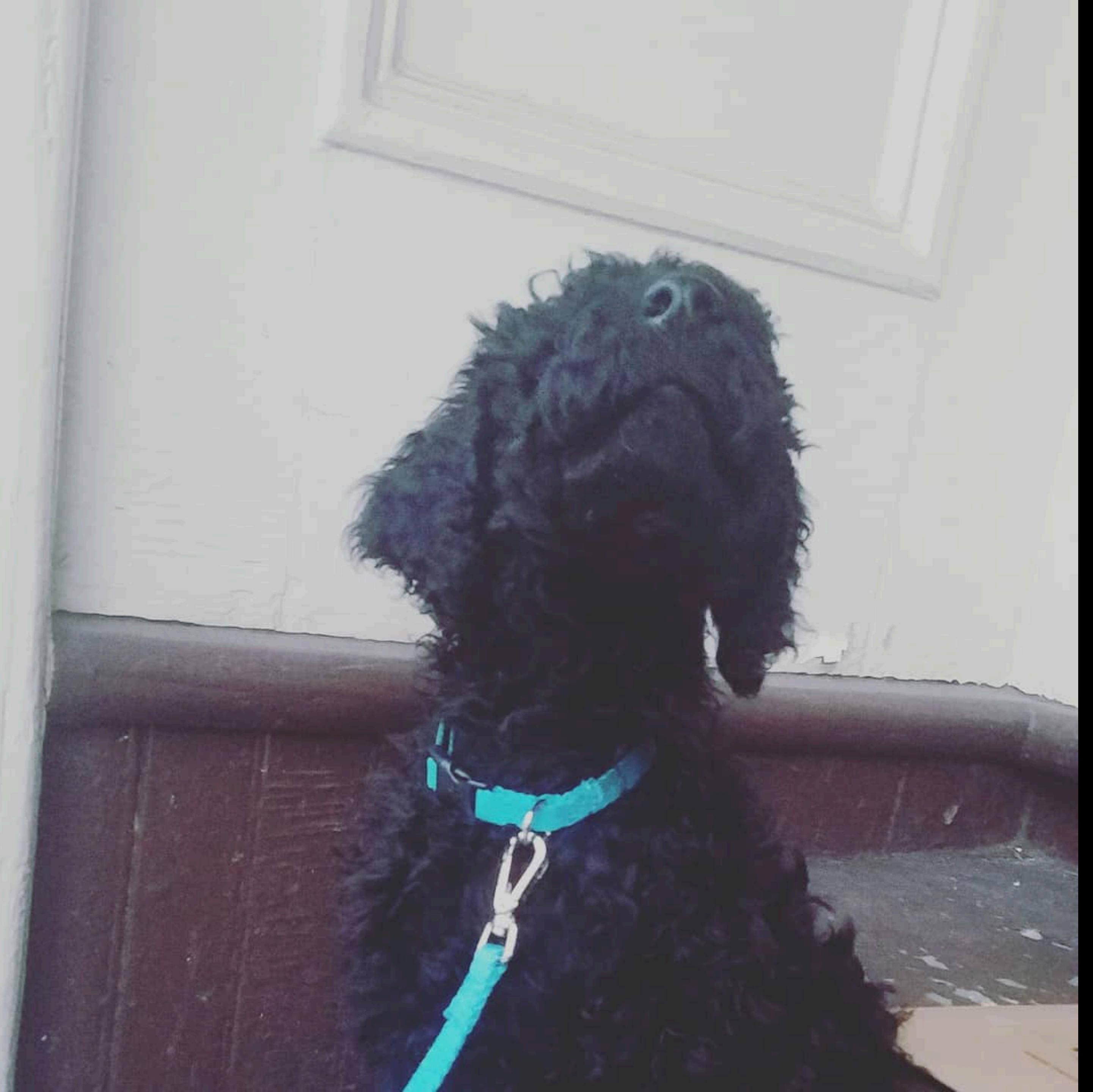
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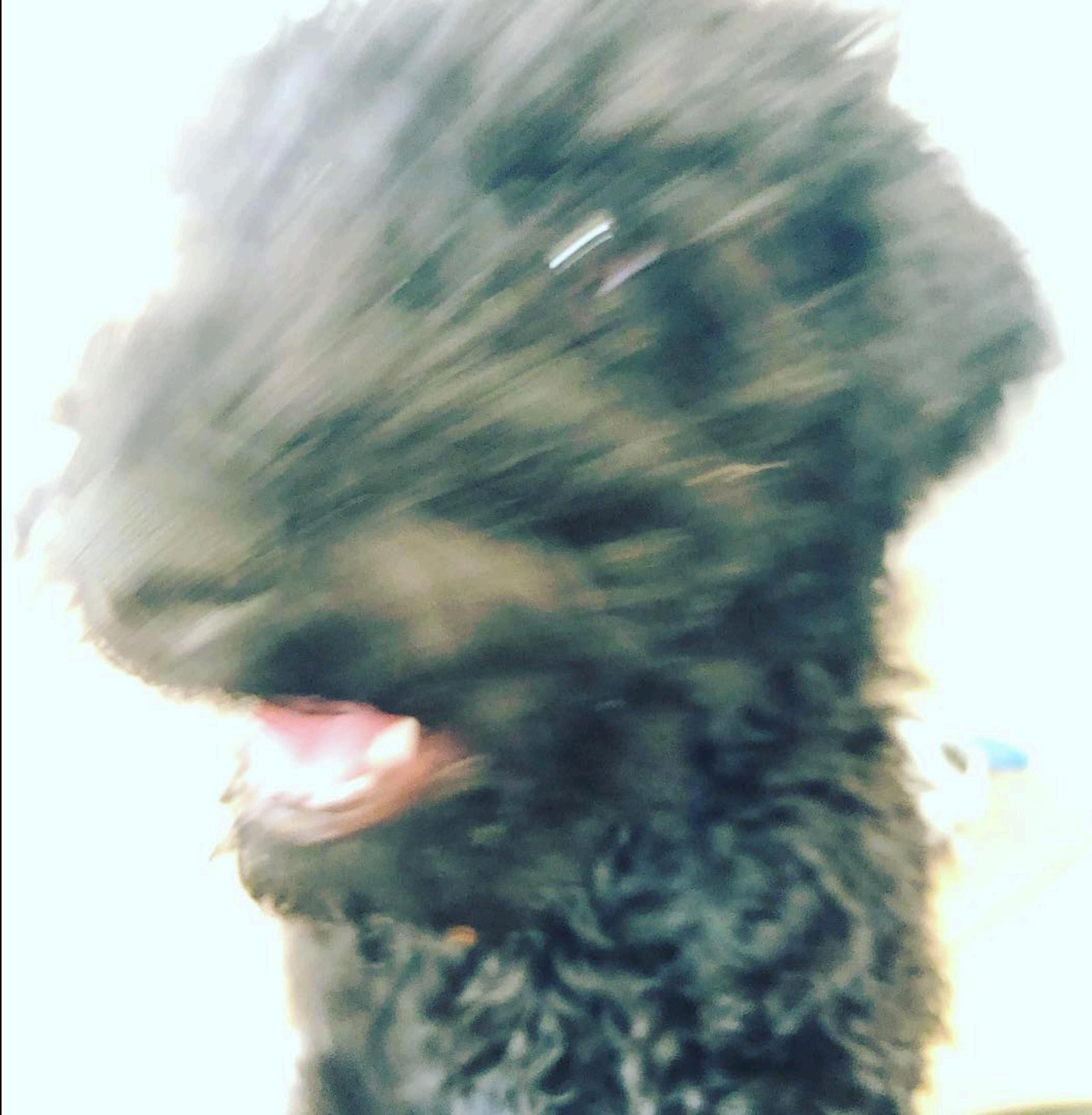
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# WHY DEEP LEARNING MATTERS

```
function login(username, password) {  
  const user = User.get(username)  
  
  if (!user) {  
    throw new Error('Bad login attempt')  
  } else if (!user.checkPassword(password)) {  
    throw new Error('Bad login attempt')  
  } else if (user.expired) {  
    throw new Error('Your subscription has expired')  
  }  
  
  return user  
}
```









I sometimes see people refer to neural networks as just “another tool in your machine learning toolbox” ... this interpretation completely misses the forest for the trees.

Neural networks are not just another classifier, they represent the beginning of a fundamental shift in how we write software.

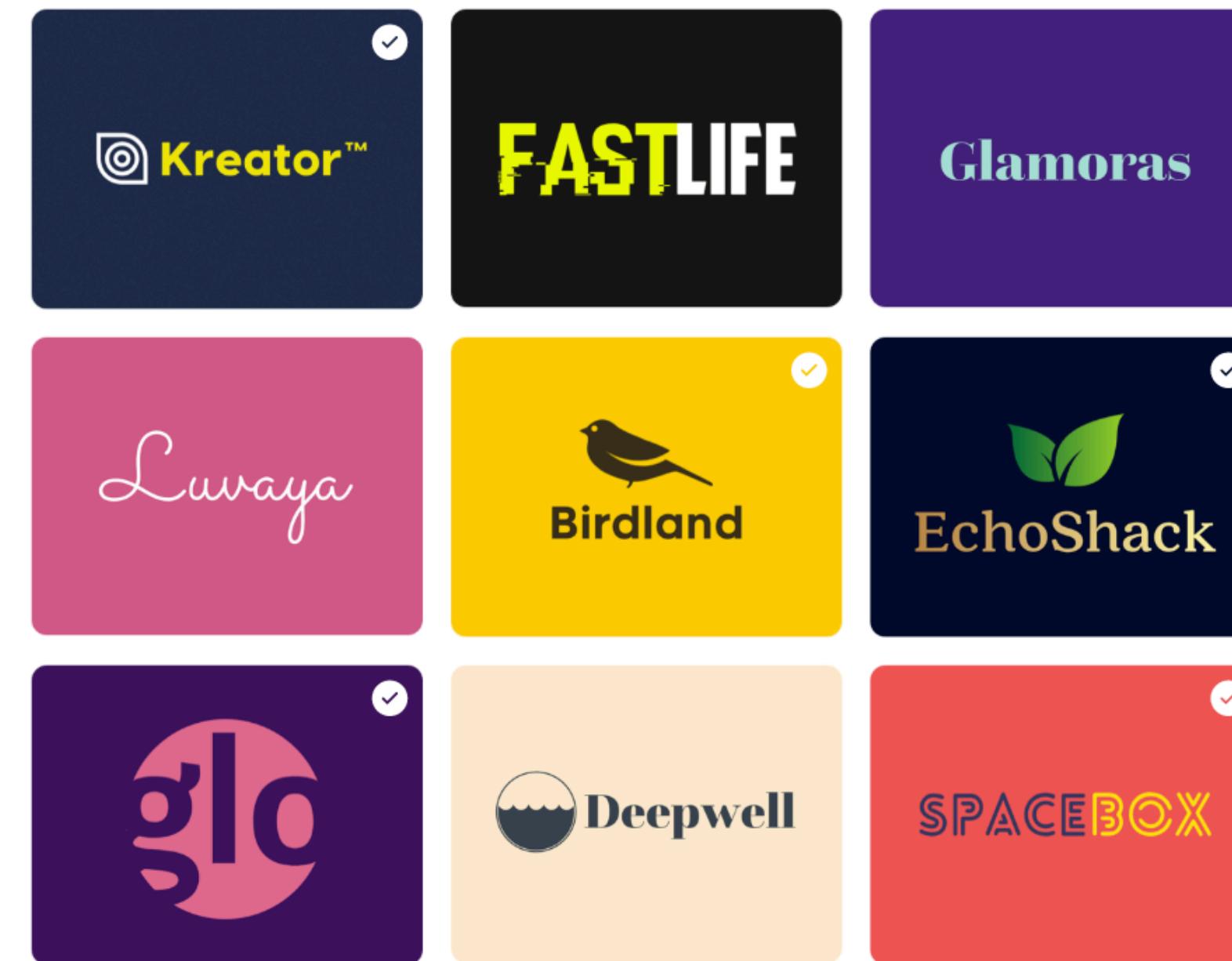
**They are Software 2.0.**

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**Andrej Karpathy**  
**Director of AI at Tesla**

# How it works

Looka combines your design preferences with AI to create a custom logo you'll love. You can then get marketing assets, build a website, and launch your business!

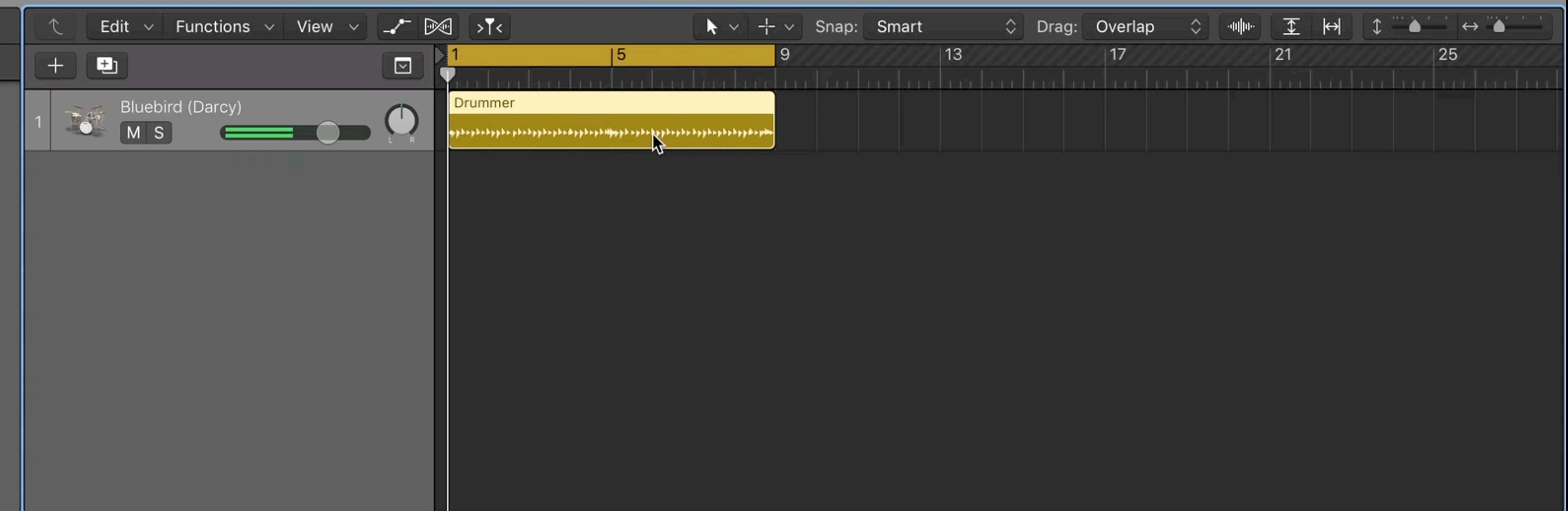


## 01. Start with design inspiration

Enter your company name and select the logo styles, colors, and symbols you like. Looka's AI-powered platform will use these as inspiration when generating your logo designs.

01:00:00:00.40 | 44.1 | Speed Only ±0.00% | 100.0000 | No In  
0001 1 1 033 | KHZ | Keep Tempo | No Out

► Region: Drummer  
► Track: Bluebird



A portrait photograph of Fei-Fei Li, a woman with dark hair, wearing a blue ribbed sweater, smiling at the camera.

“Even a cat has  
things it can do  
that AI can not.”

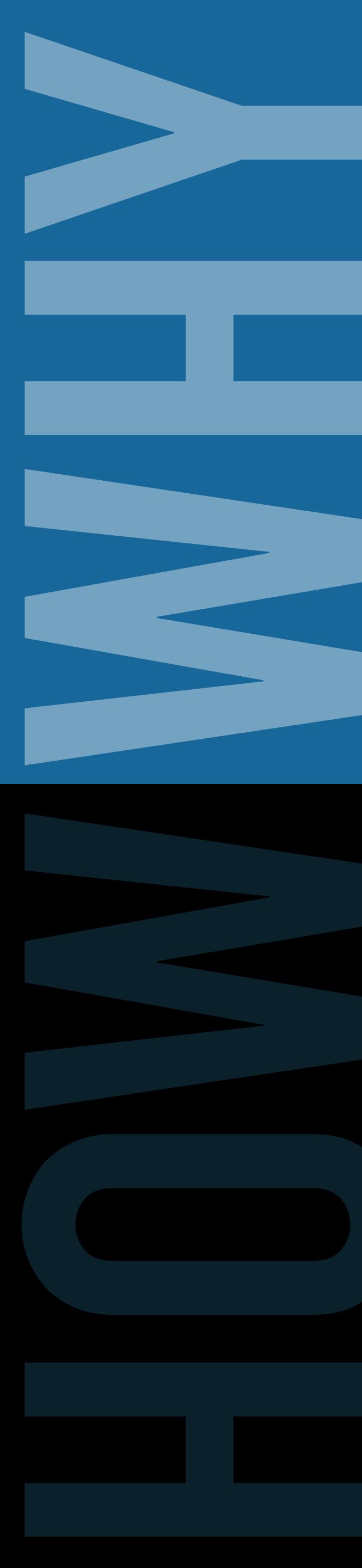
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Fei-Fei Li  
Stanford’s AI Institute

## CHALLENGES

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1. Mindshare
2. Data
3. UX

- 
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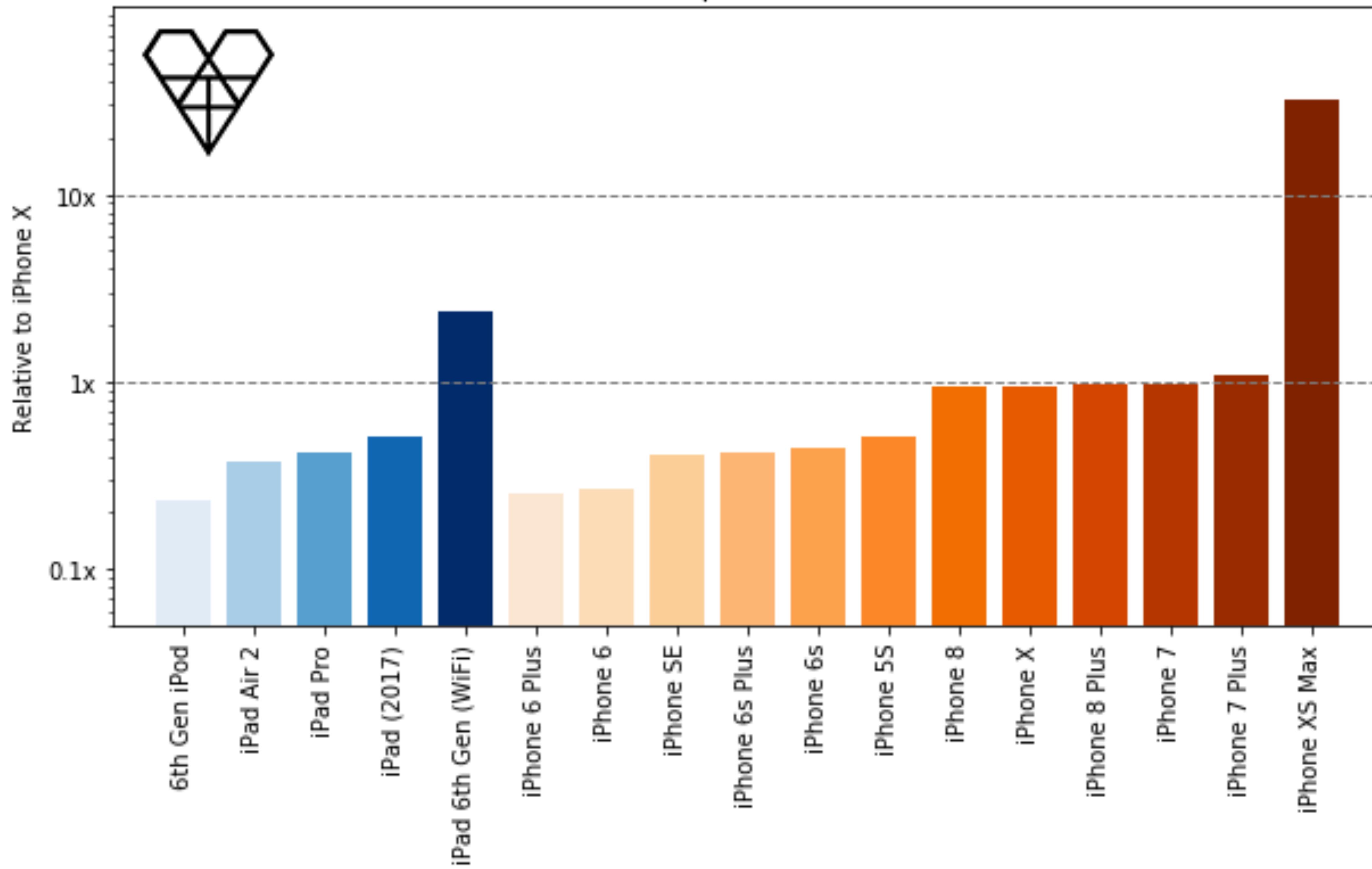
# EDGE INTELLIGENCE

**Reboot and Select proper Boot device  
or Insert Boot Media in selected Boot device and press a key**





## Core ML Runtime Speed Relative to iPhone X



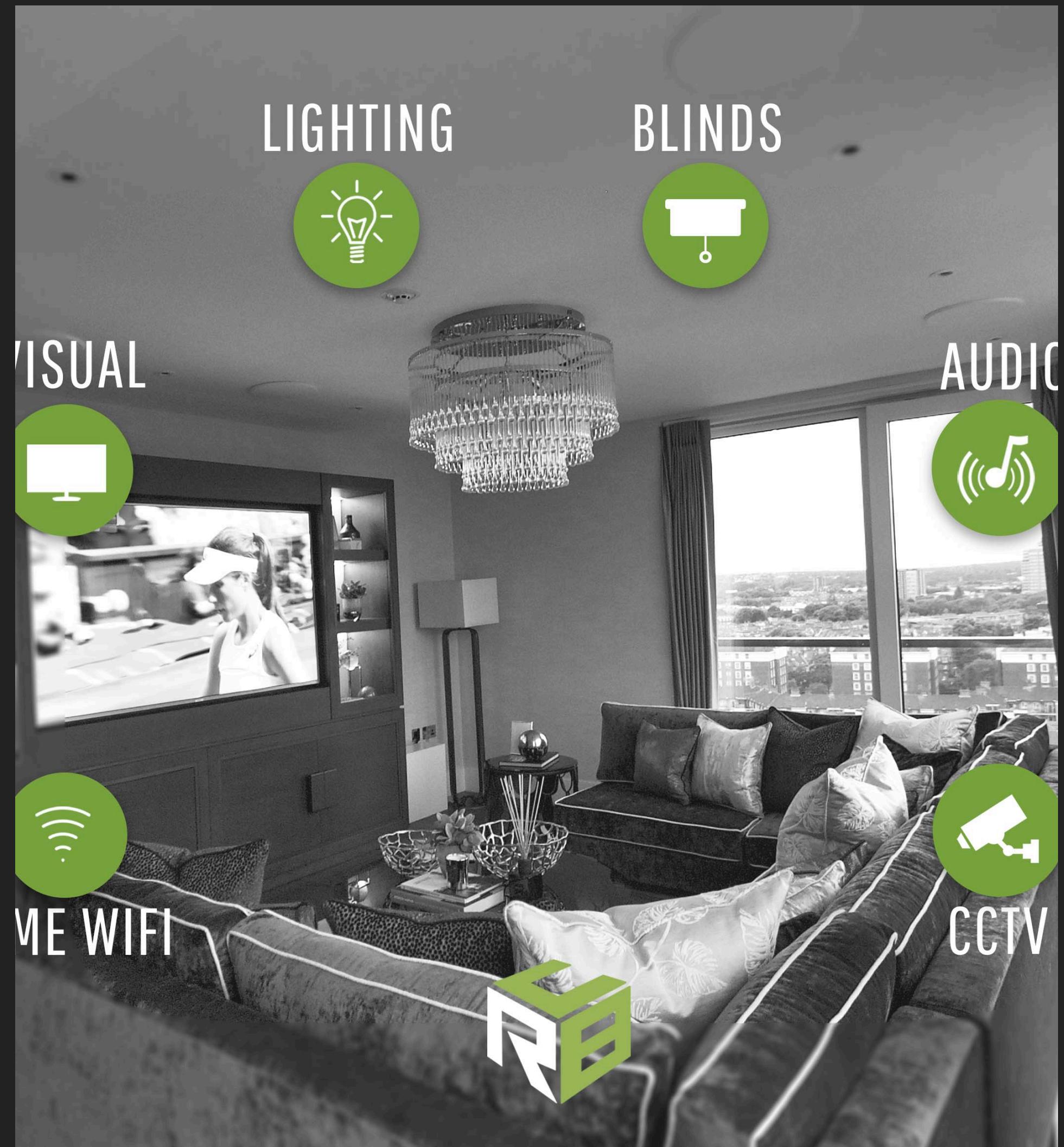
# EDGE INTELLIGENCE

‘Running Inference and  
Training of Neural Networks  
on Consumer Devices’

# EDGE INTELLIGENCE

---

- ▶ Privacy
- ▶ Latency
- ▶ Offline
- ▶ Speed
- ▶ Bandwidth



# EDGE INTELLIGENCE

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- ▶ Privacy
- ▶ Latency
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- ▶ Speed
- ▶ Bandwidth



# EDGE INTELLIGENCE

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# EDGE INTELLIGENCE

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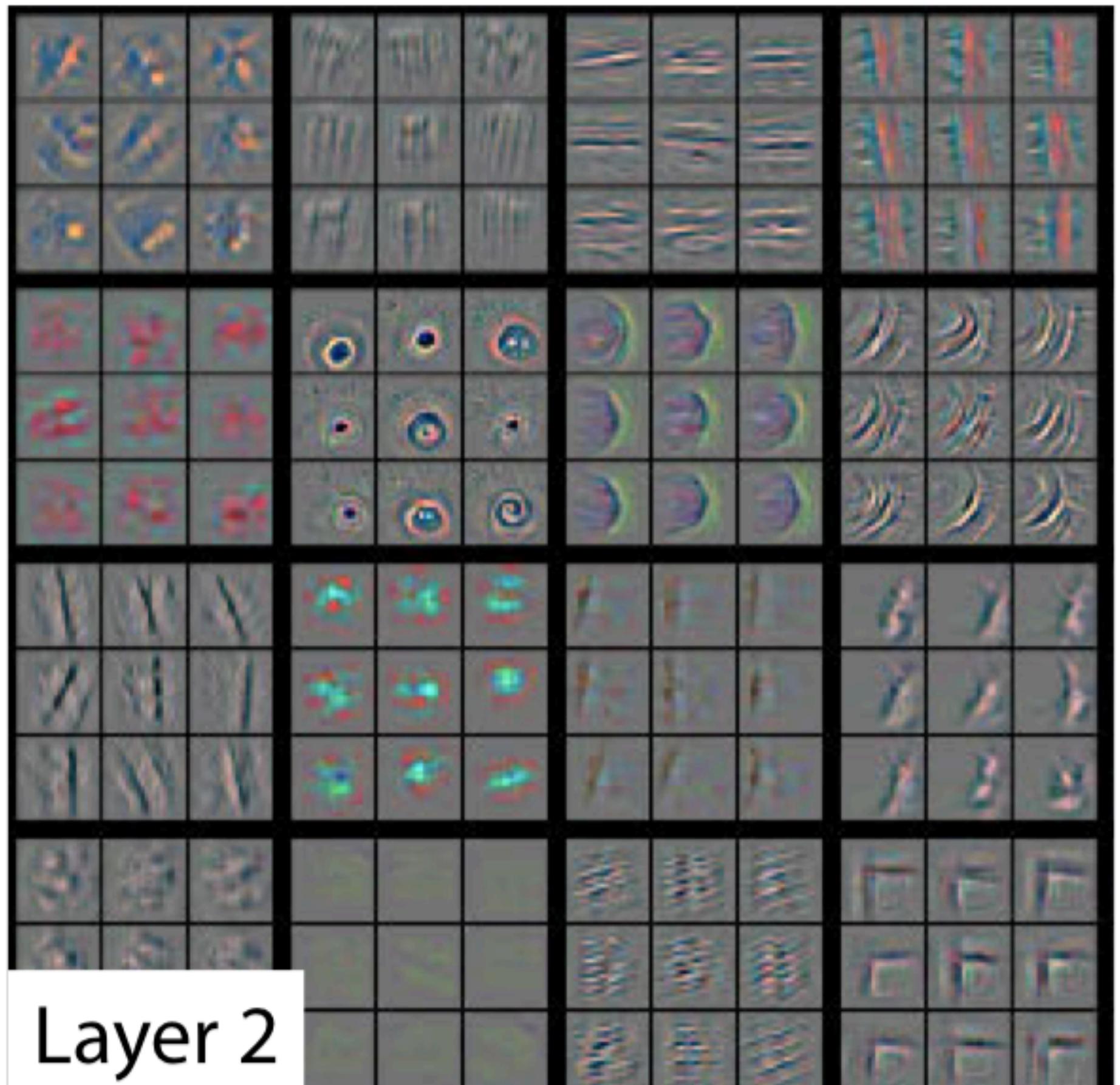
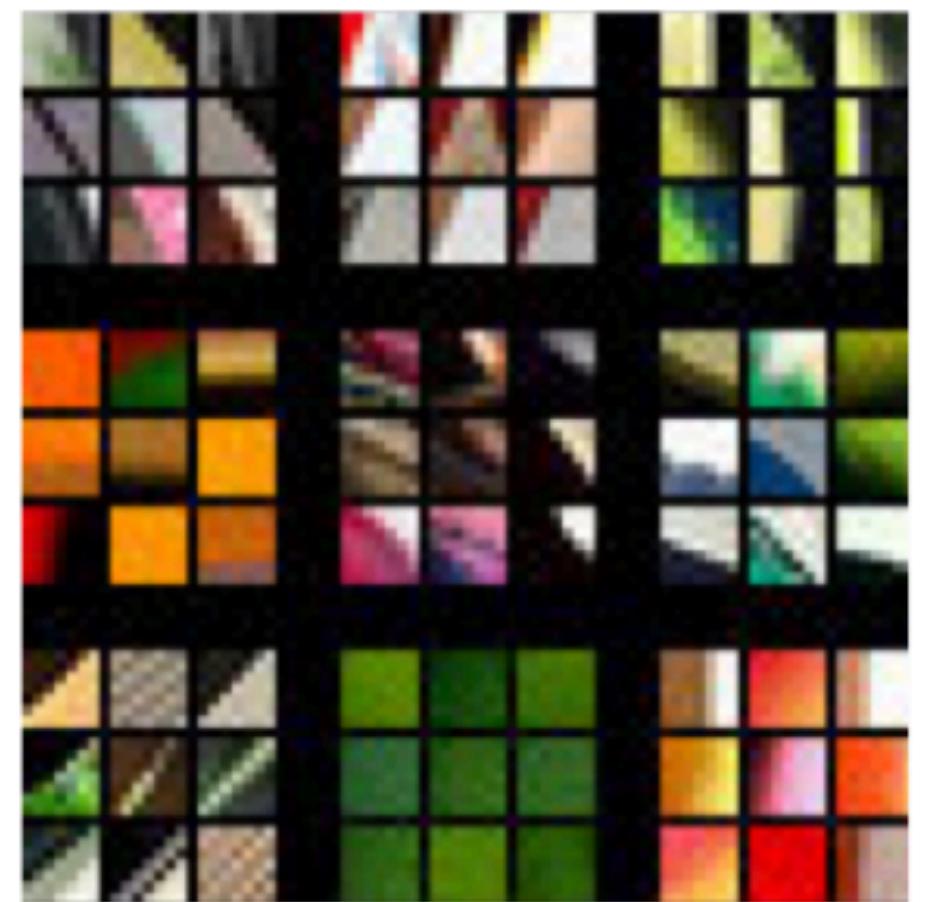
# TRANSFER LEARNING

A machine learning method where a model developed for a task is reused as the starting point for a model on a second task.

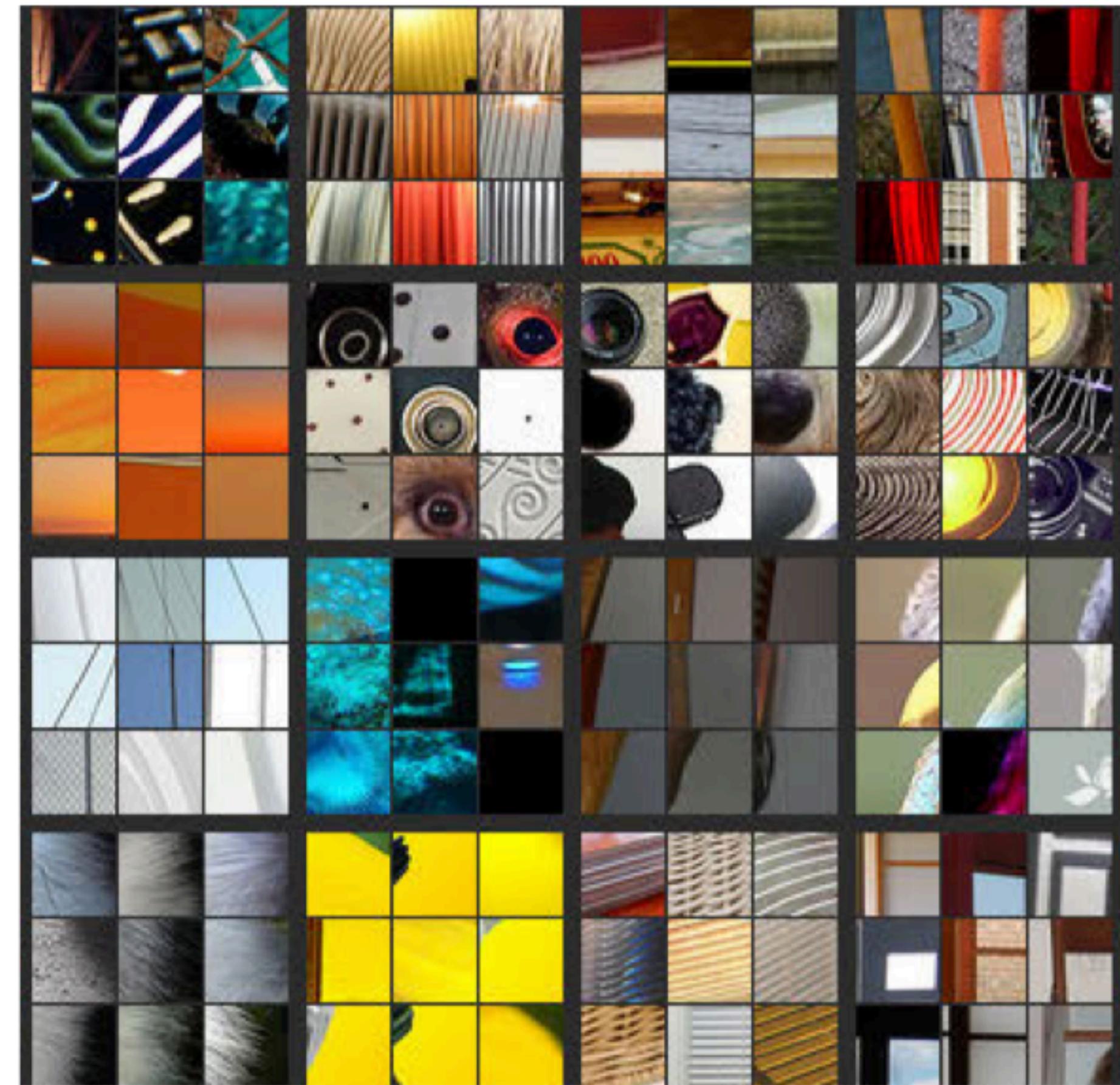
– Jason Brownlee



Layer 1

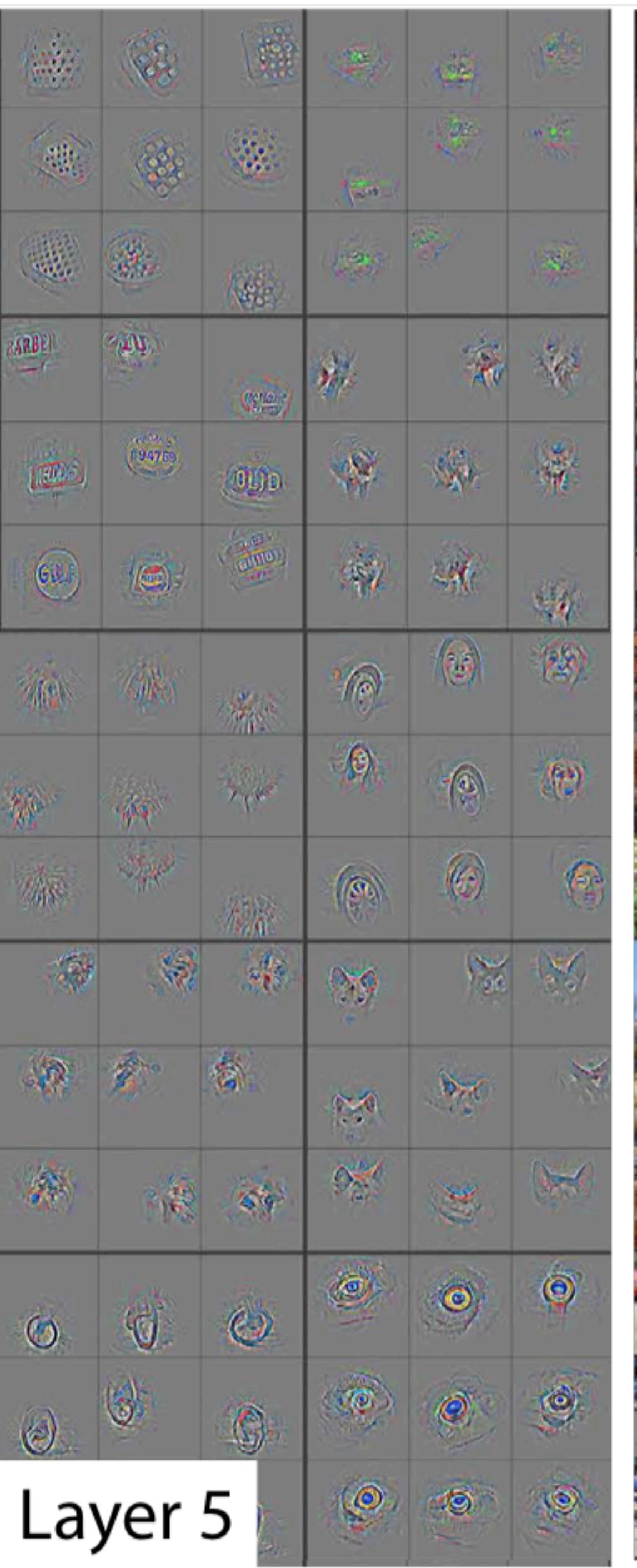
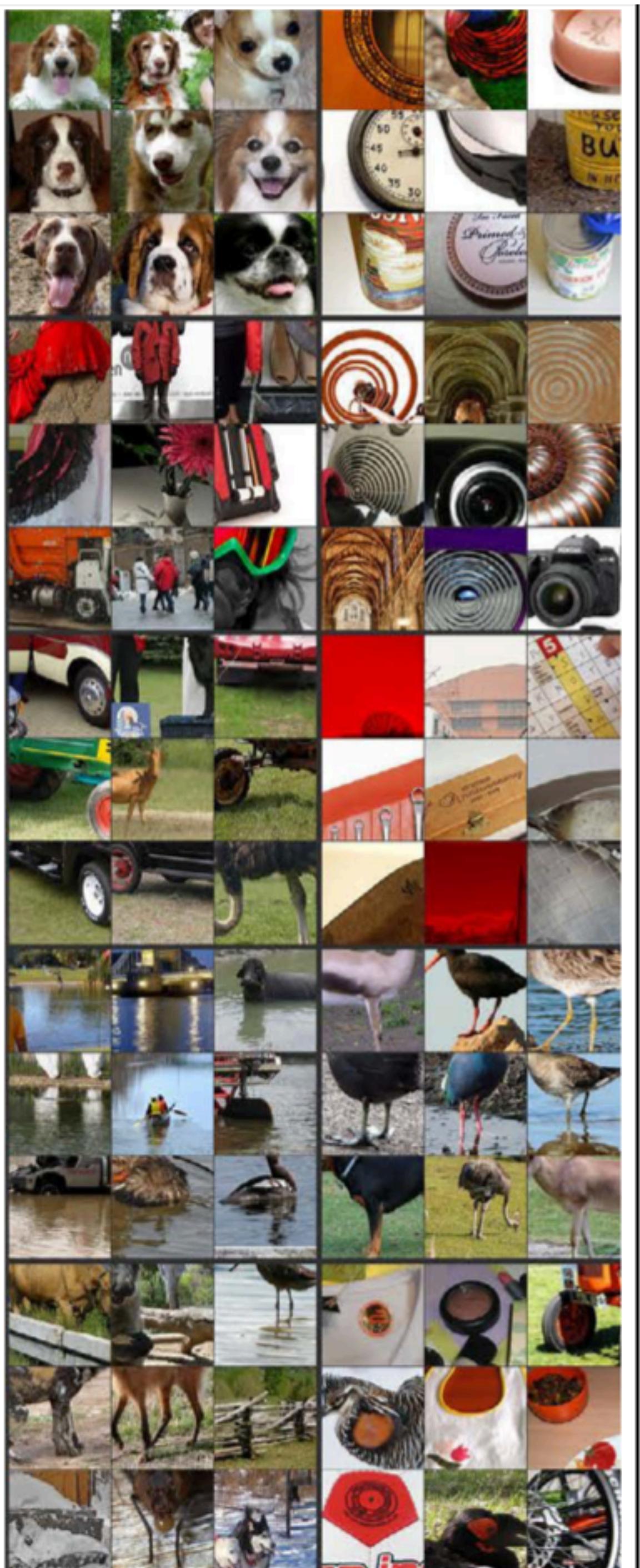


Layer 2

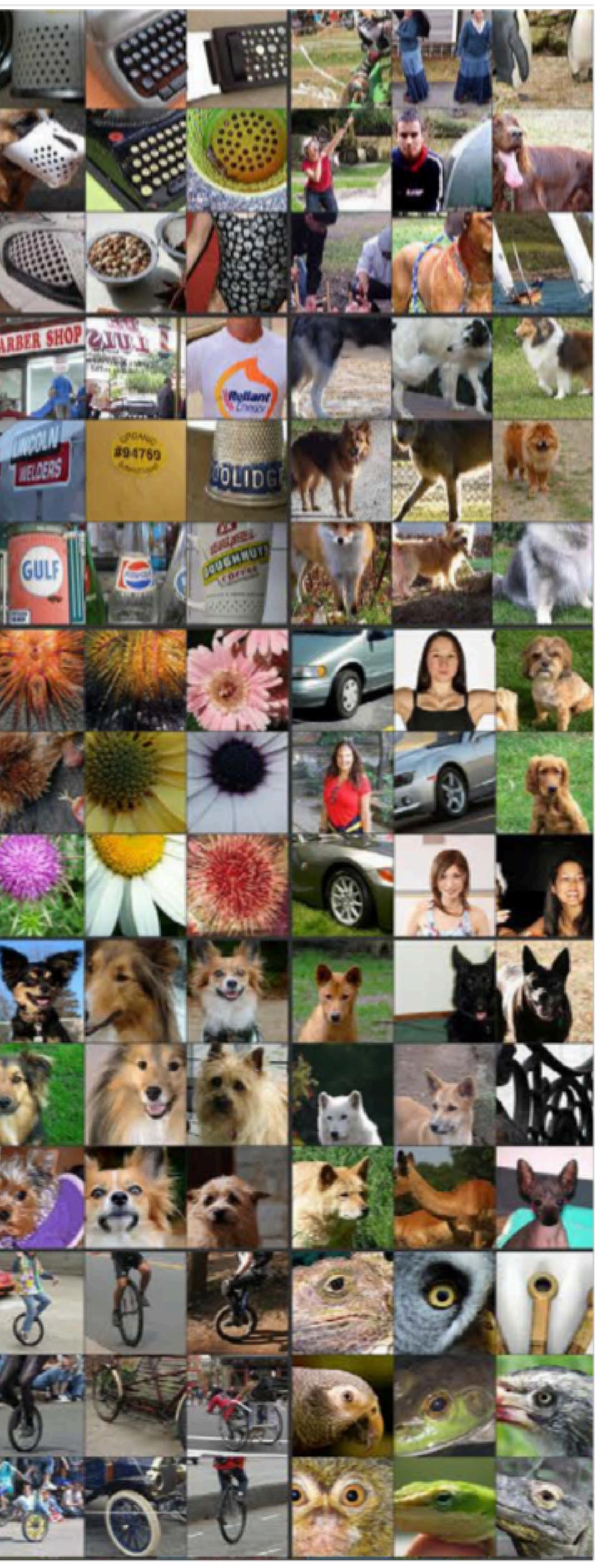




Layer 4

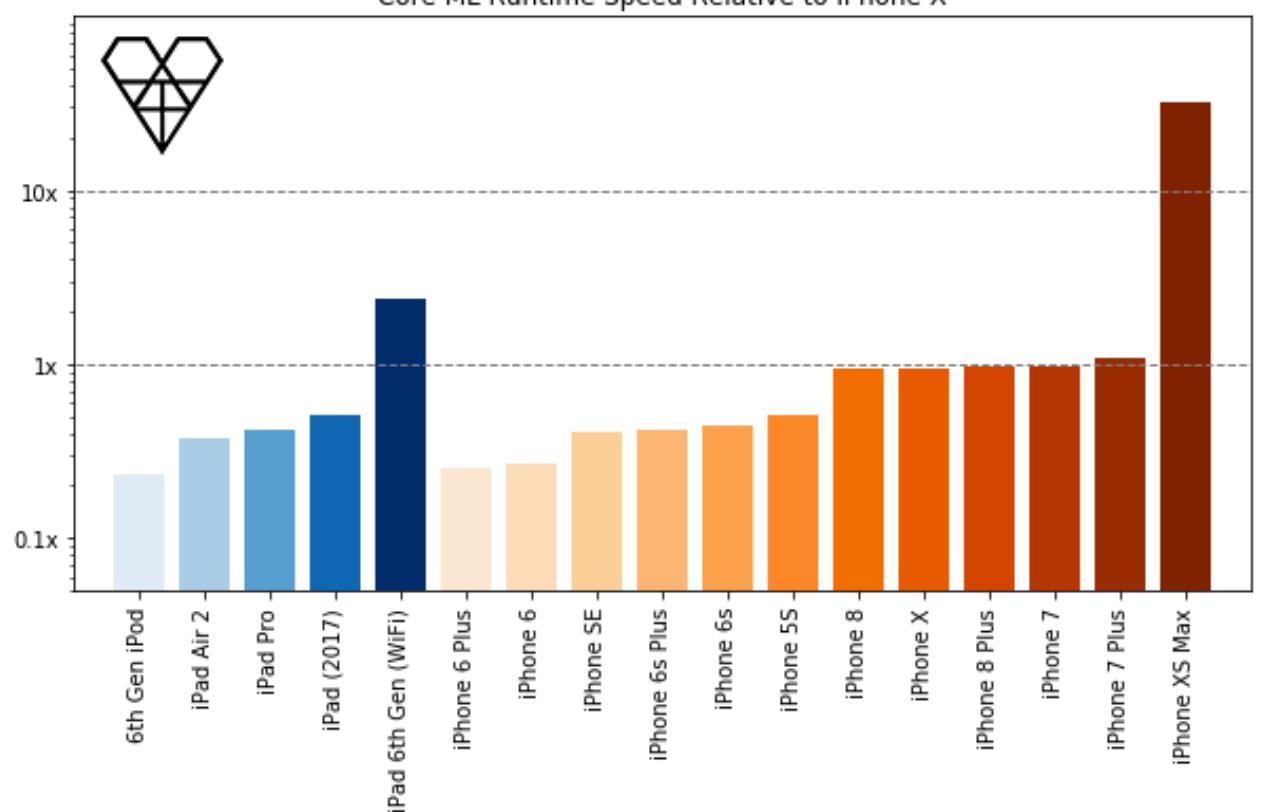


Layer 5



1

# Hardware Support for on-device Neural Networks



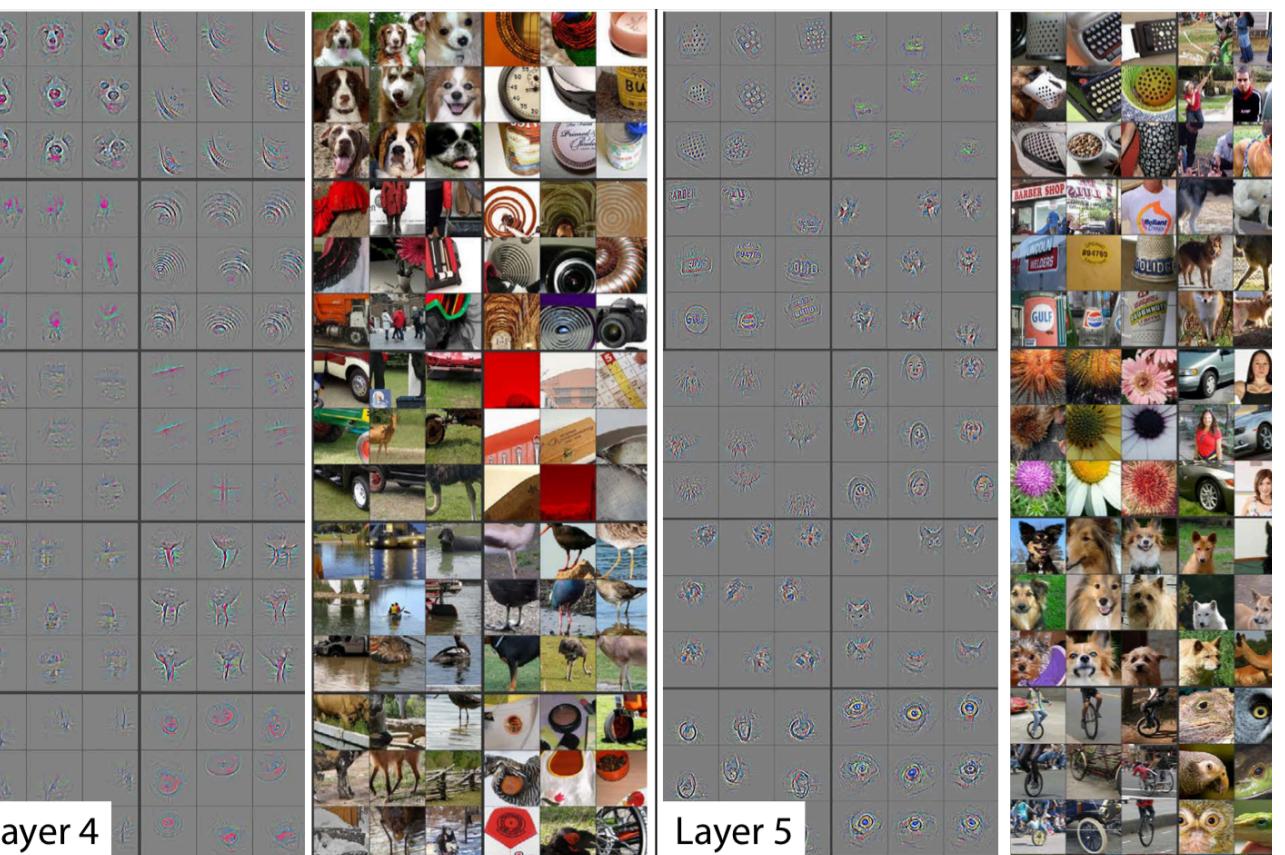
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# Privacy and Latency Concerns



3

# Research Advancements





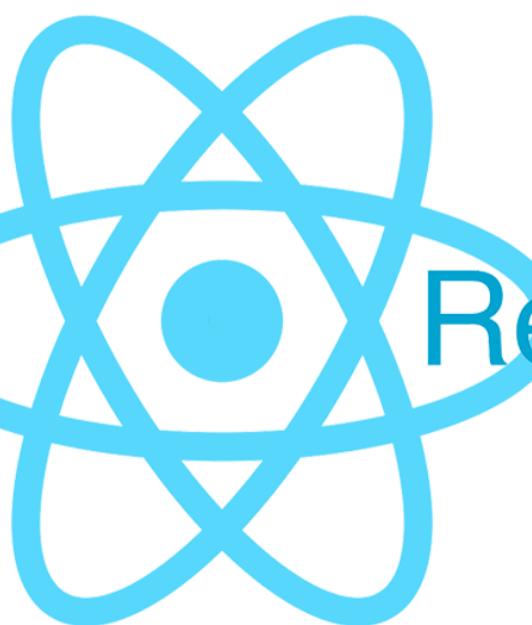
# Atwood's Law

"Any application that can  
be written in JavaScript,  
will eventually be written  
in JavaScript."

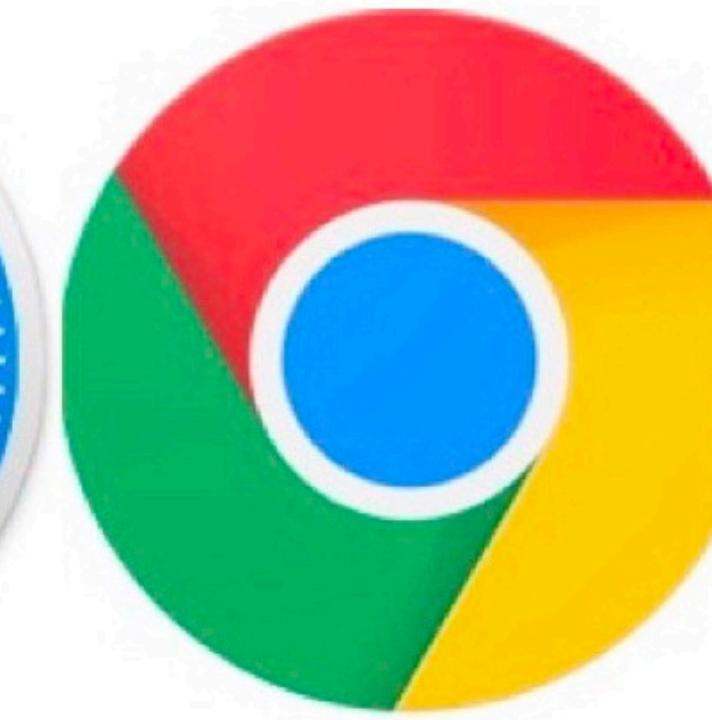
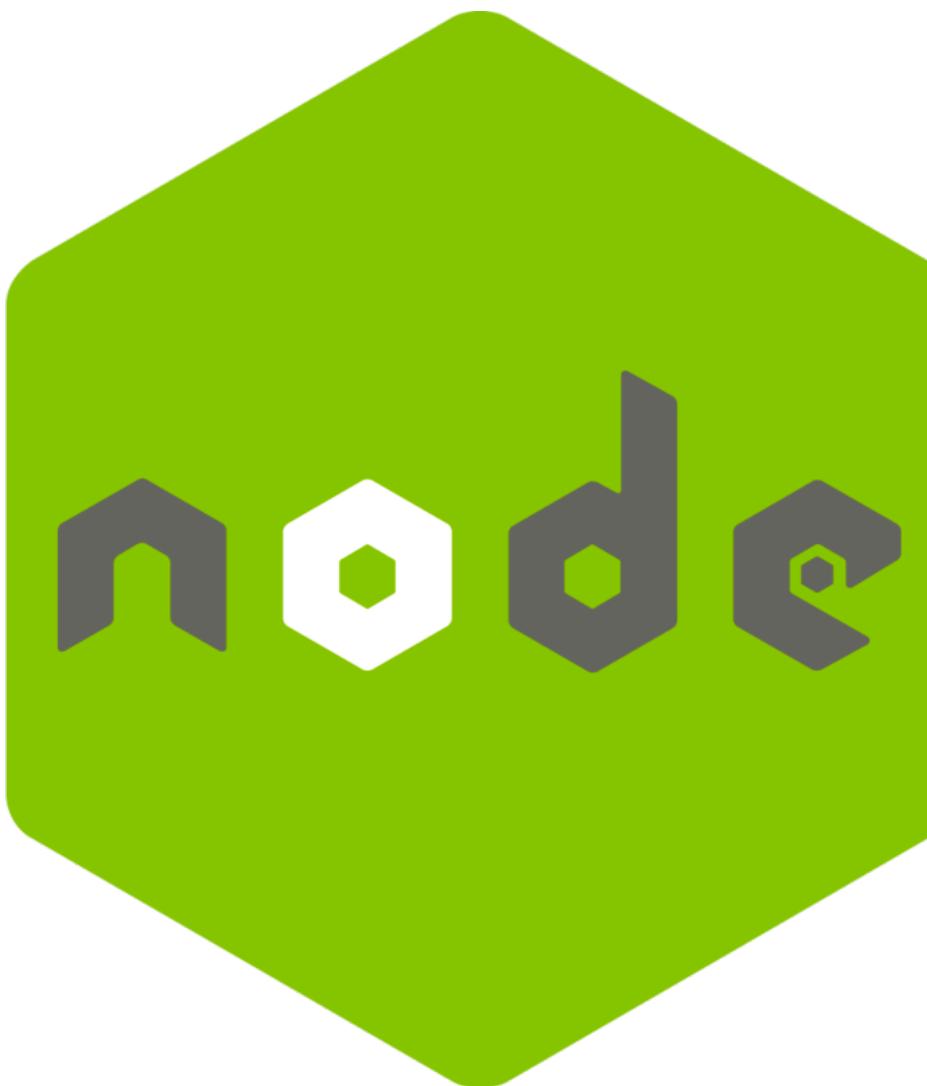
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**Jeff Atwood**  
**Founder of Stack Overflow**

# JAVASCRIPT IS EVERYWHERE



React Native



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# A SIMPLE NEURAL NETWORK

(live demo)

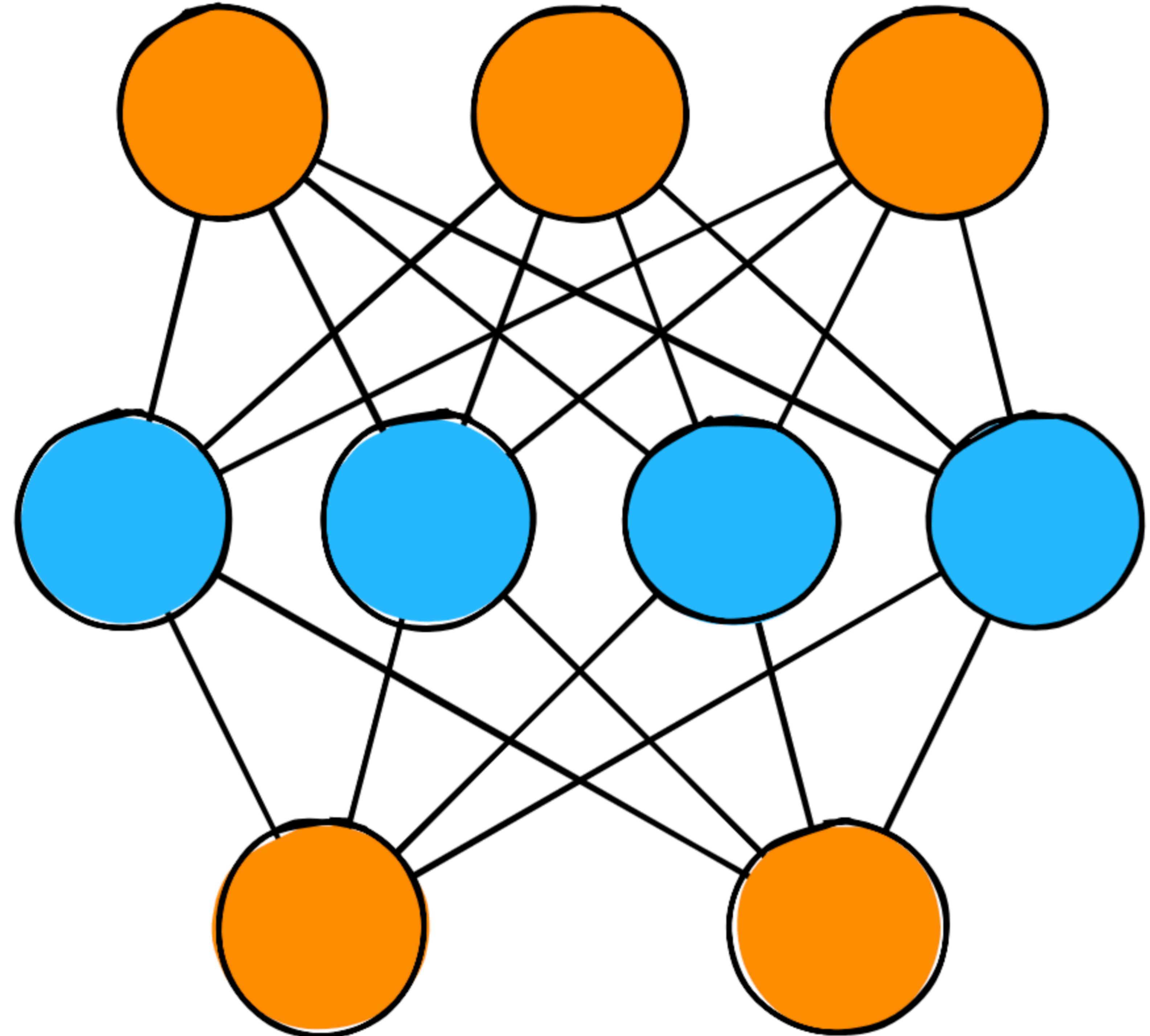
The image shows a web development environment with three tabs: HTML, CSS, and JS. The HTML tab contains script tags for loading external files and a button labeled "Begin". The CSS tab contains styles for the body and a chart container, setting padding, margin, height, and width to 0px. The JS tab contains a JSON object named "data" with five entries, each containing "x" and "y" values. Below the tabs is a live demo of a chart with a red line showing a positive linear trend. A purple button labeled "TRAIN" is visible on the left.

```
HTML:
<script>
src="https://code.jquery.com/jquery-3.6.0.min.js"></script>
<script>
src="https://cdn.jsdelivr.net/npm/Phaser@3.7.3/dist/phaser.min.js"></script>
<script>
src="https://cdn.jsdelivr.net/npm/phaser-flow@1.0.0-alpha.1/dist/phaser-flow.min.js"></script>
<script>
src="https://cdn.jsdelivr.net/npm/phaser-flow@1.0.0-alpha.1/dist/phaser-flow-particles-and-mix.min.js"></script>
<div id="container">
<button id="begin">Begin</button>
<div id="chart"></div>
</div>
</div>
```

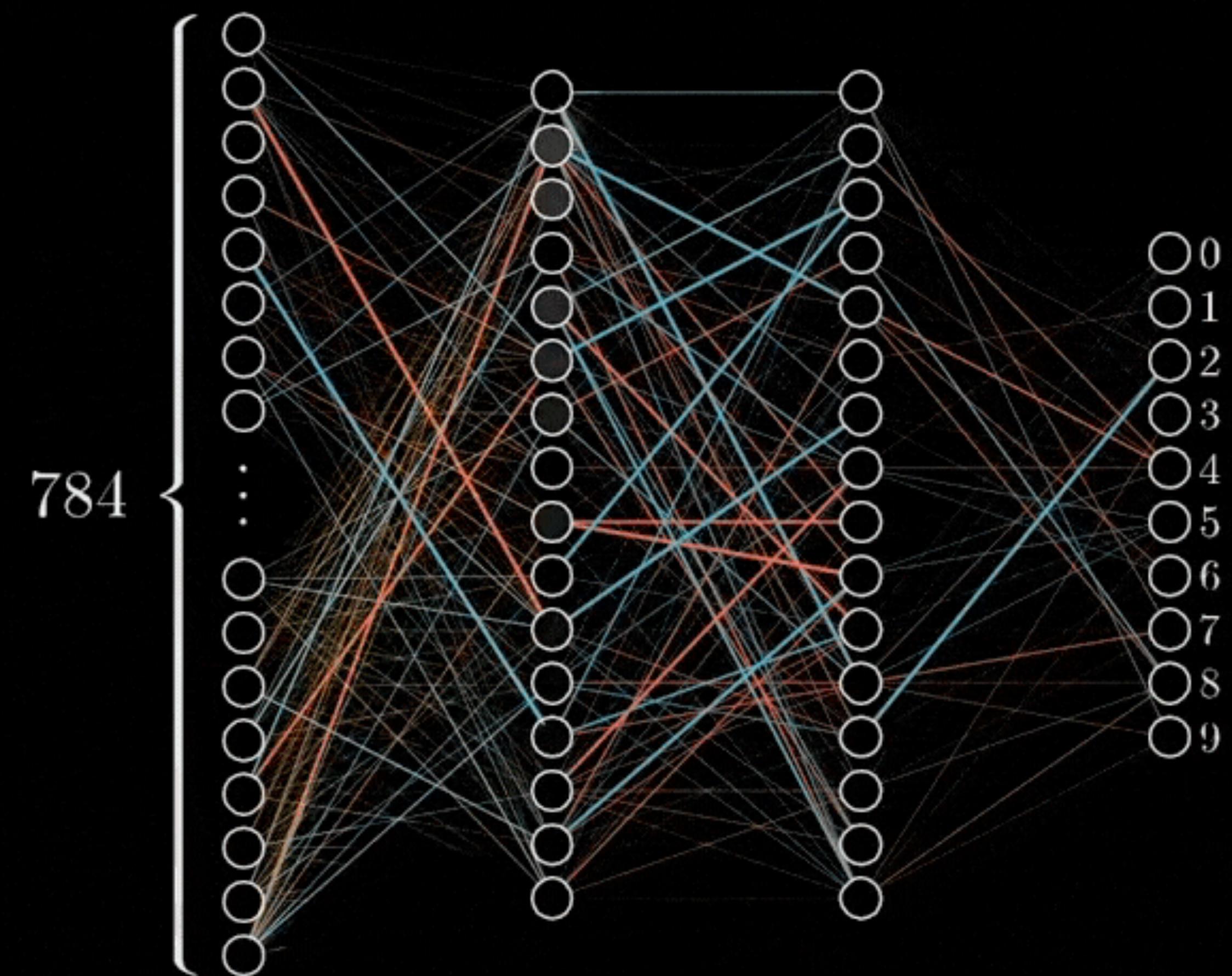
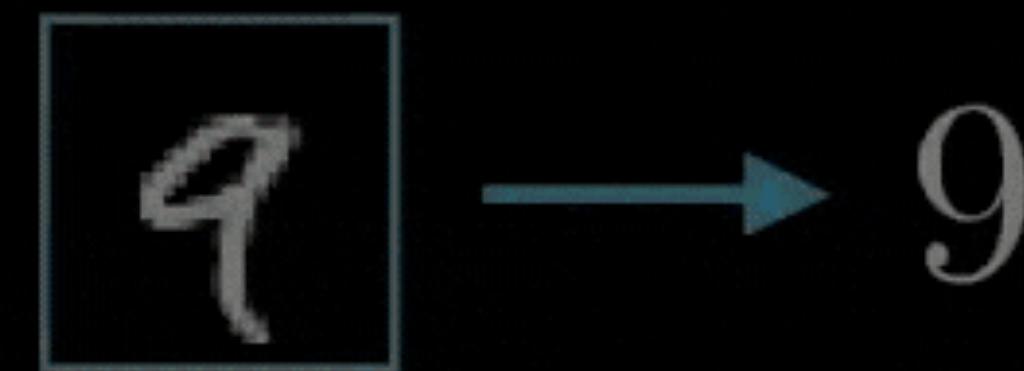
```
CSS:
body, body {
padding: 0;
margin: 0;
height: 100px;
width: 100px;
}
body {
}
.container {
width: 100px;
}
#chart {
width: 100px;
}
```

```
JS:
const data = [
{x: 1, y: 1}, {x: 2, y: 2}, {x: 3, y: 3}, {x: 4, y: 4}, {x: 5, y: 5}
]
```

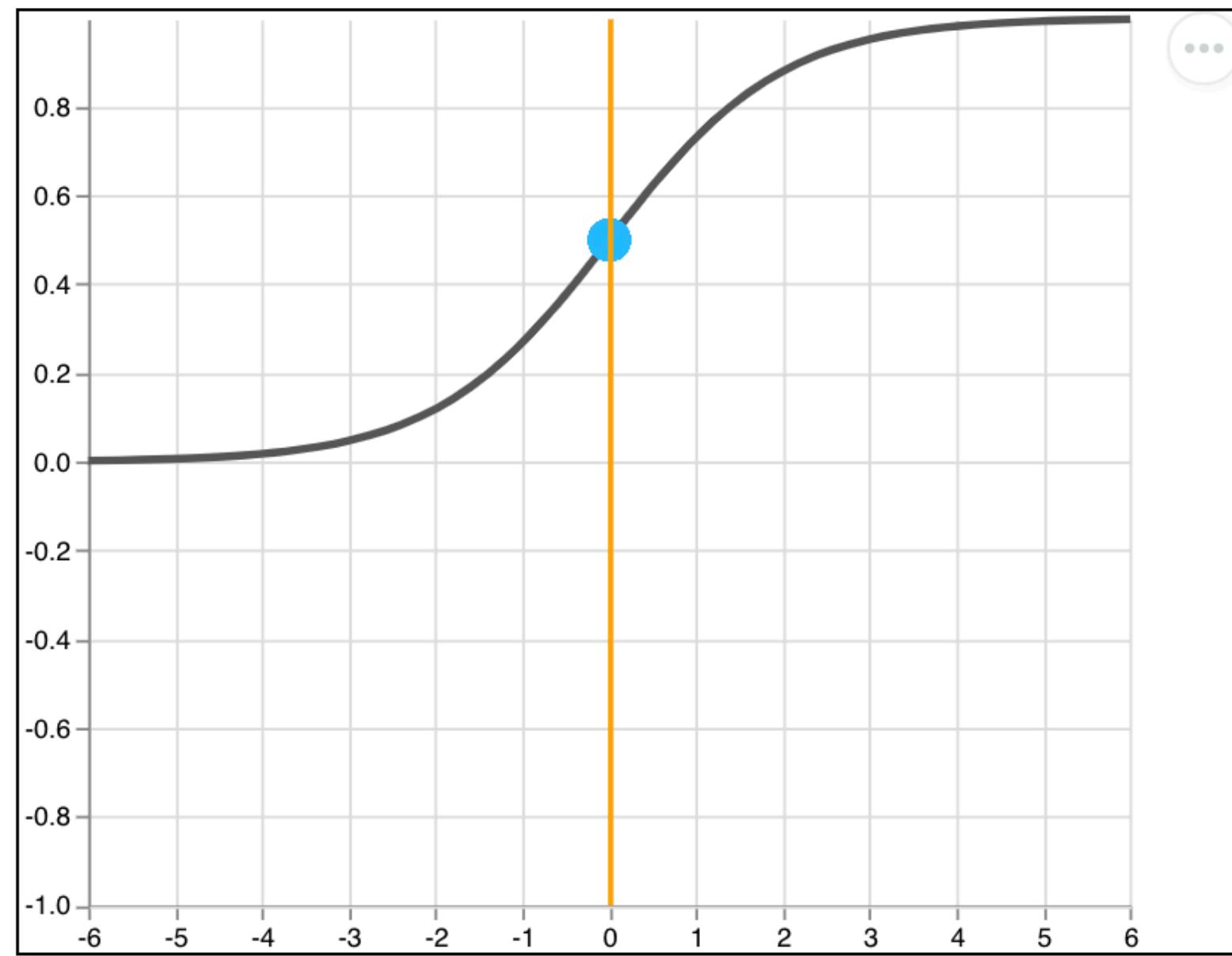
<https://codepen.io/thekevinscott/pen/Jxameq>



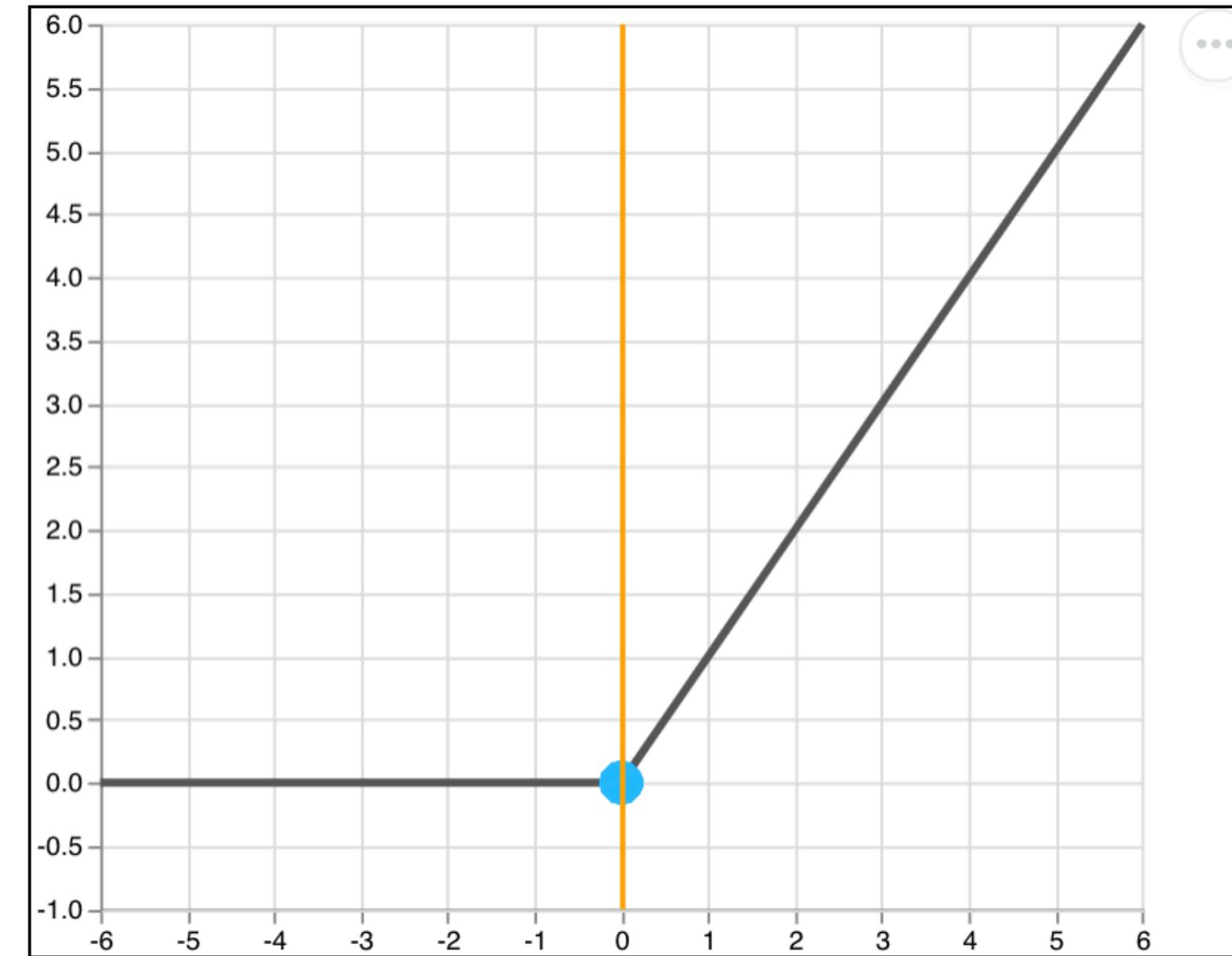
Training in  
progress. . .



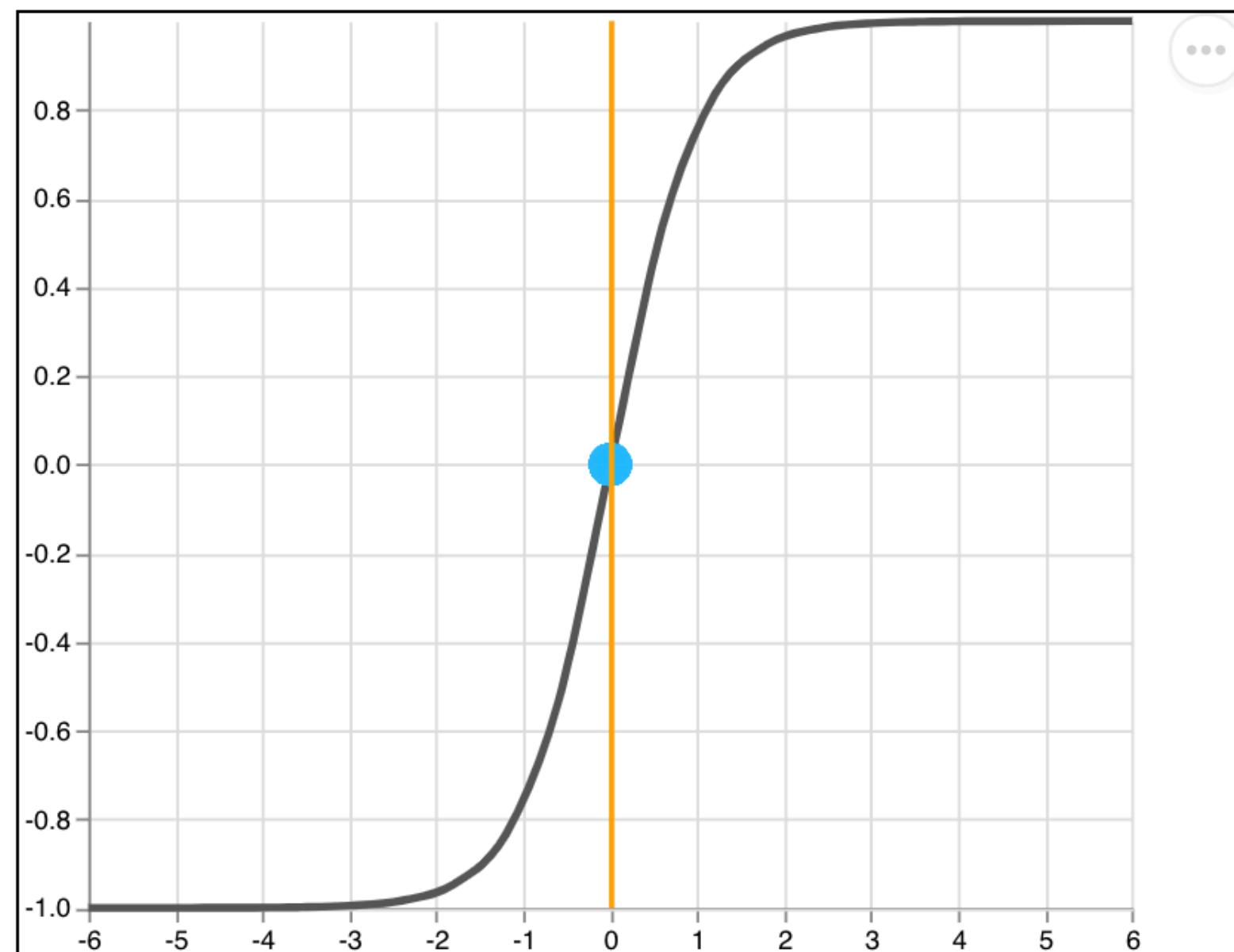
Sigmoid



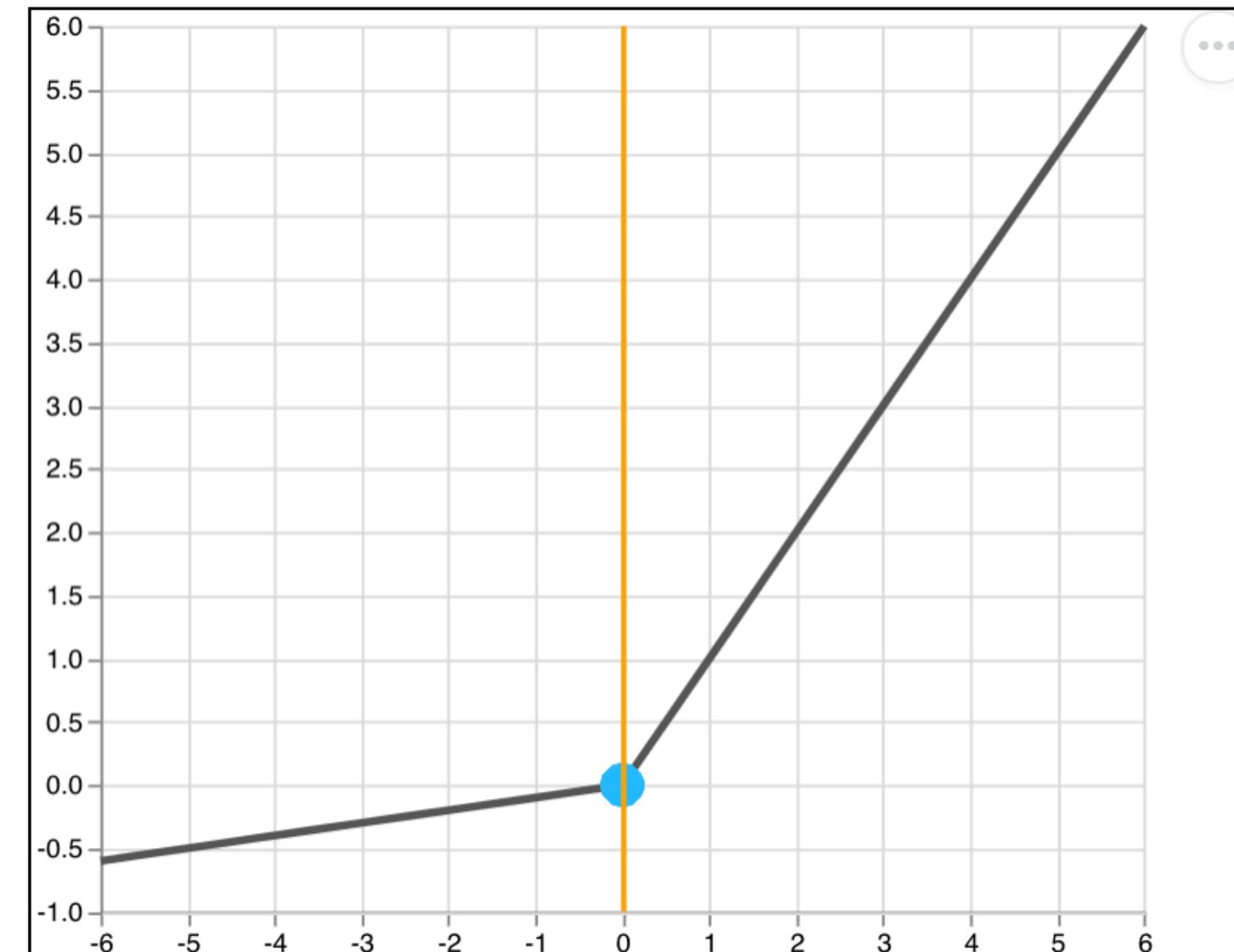
ReLU



TanH



Leaky ReLU





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# 4

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# TRANSFER LEARNING FOR IMAGES

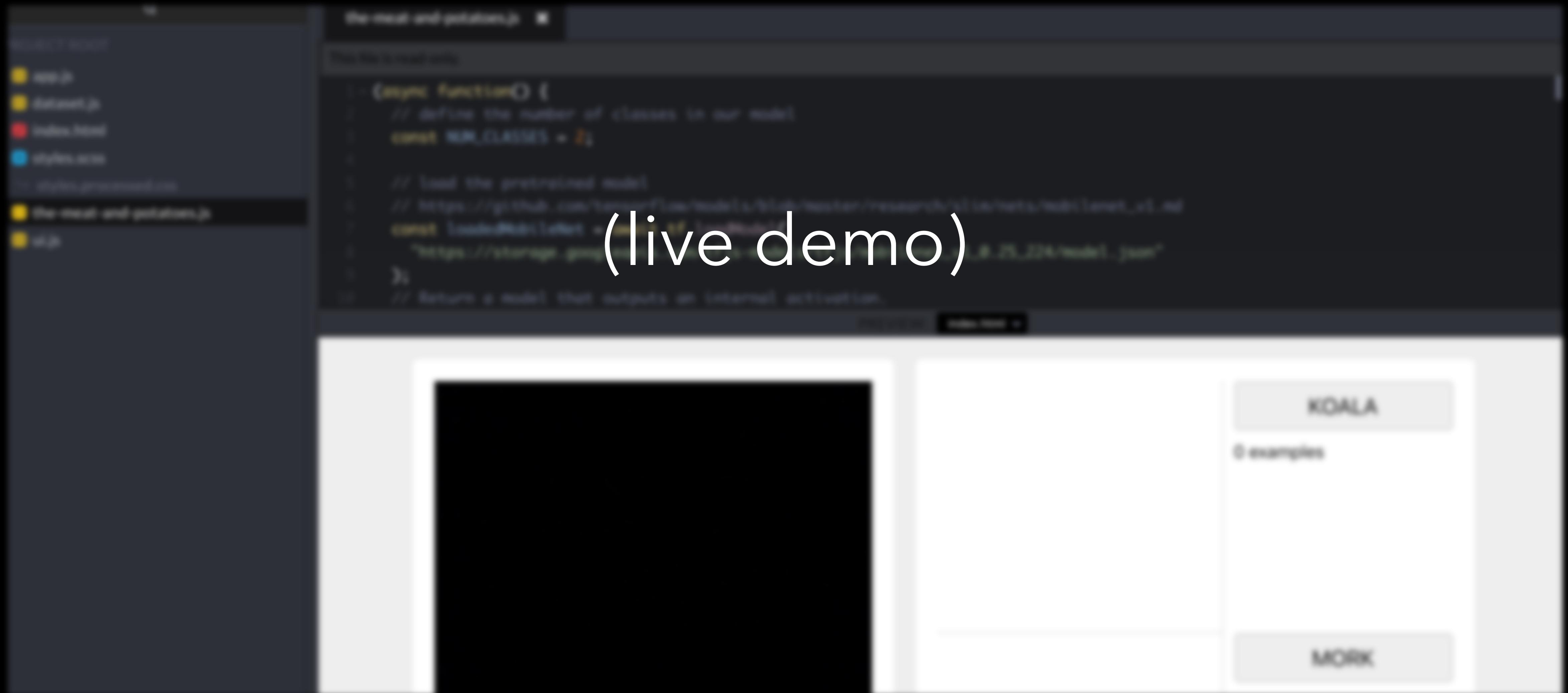


“There's the joke that 80 percent of data science is cleaning the data and 20 percent is complaining about cleaning the data ... Actually training models is typically a relatively small proportion of what a machine learner or data scientist does.”

---

**Anthony Goldbloom  
Founder of Kaggle**

(live demo)



<https://codepen.io/thekevinscott/project/editor/DvGbxE>



# THANKS!

*Buy the book*

**[dljsbook.com](http://dljsbook.com)**

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*Slides: [dljsbook.com/fullstack](http://dljsbook.com/fullstack)*

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