

# Machine Learning in Swift

Practical, Trendy, or Both?

Hello.



# Who Am I?

- I am 15 years old
- I live on Long Island in New York
- I love to ski
- “Self-Taught” iOS Developer





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# The Past

# The Present

# The Future

**Episode III**

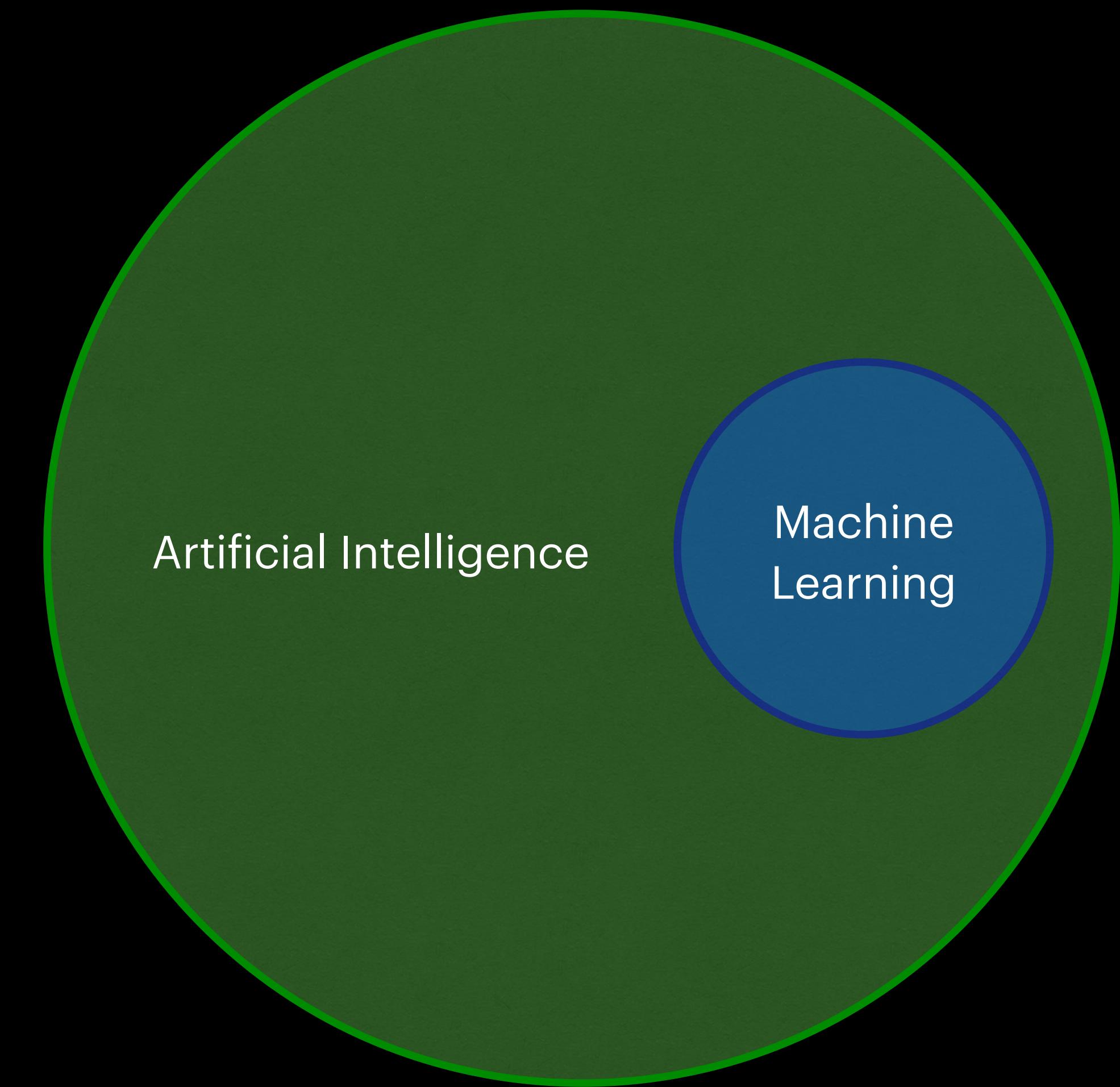
## **BEN TALKS ABOUT ML**

*Needing to come up with another fun intro, BEN has resorted to the most generic aspect of nerd culture: STAR WARS.*

*Little did BEN know, STUNT DOUBLE JOSH would prove his point with a STAR WARS meme in his presentation like 3 hours ago.*

# What is Machine Learning?

# What is Machine Learning?



# What is Machine Learning?

- Neural Network
- Decision Trees
- Support Vector Machines
- Hidden Markov Models
- Bayesian Networks
- Linear Regression
- K-means
- Tabular Reinforcement Learning

**“How do I use it?”**

-You, maybe

# Training

- Data
- Supervision
- Laziness

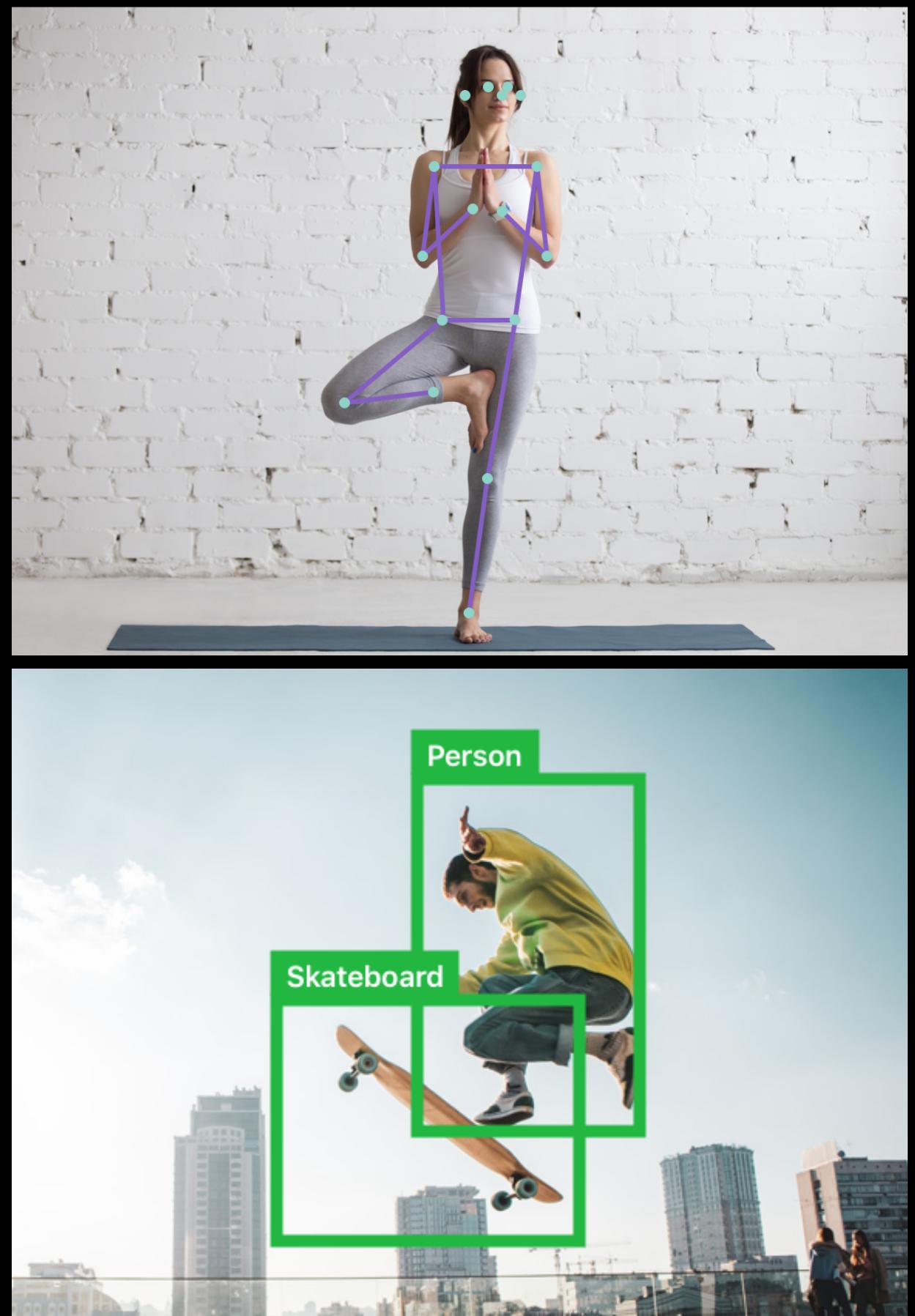
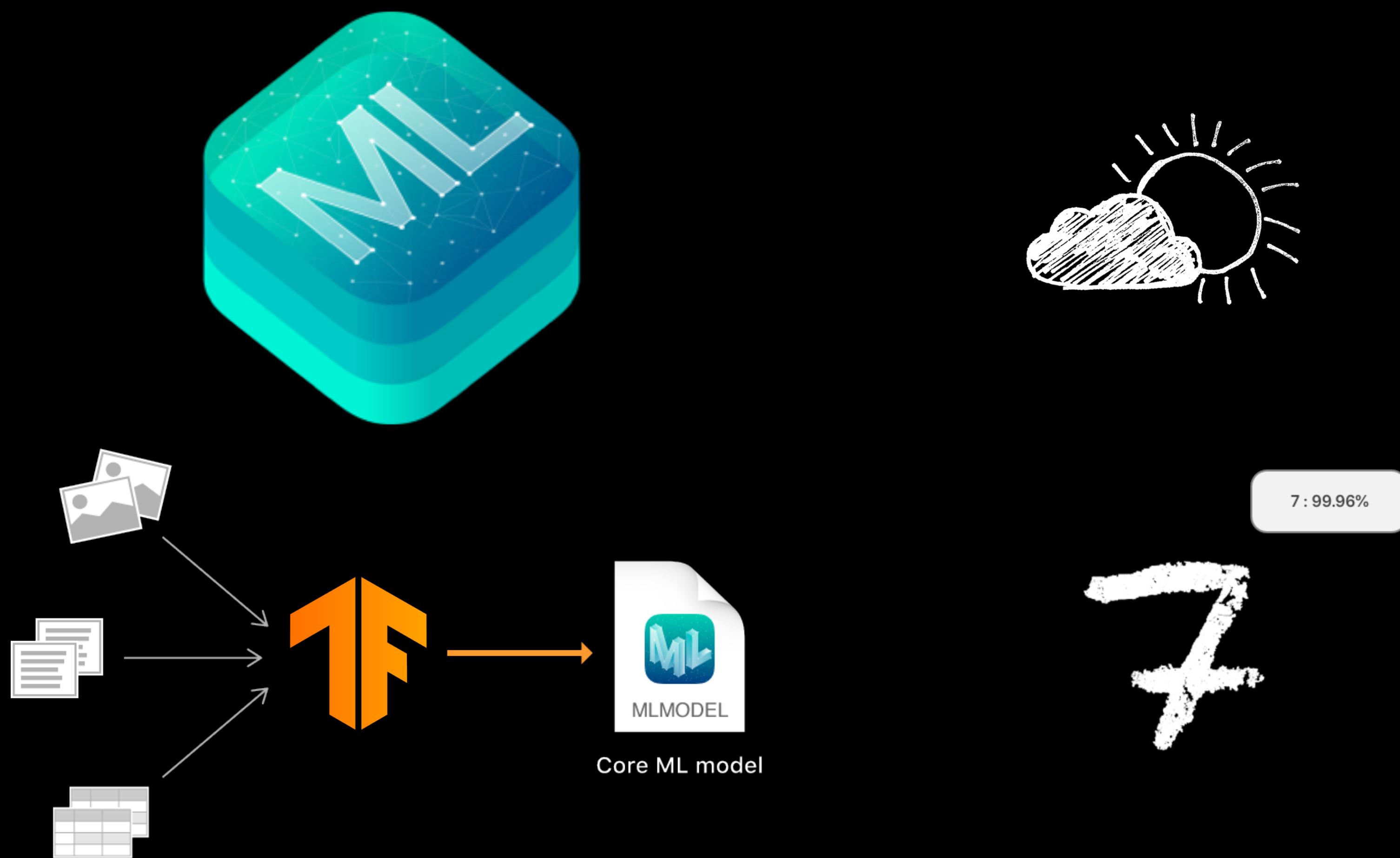


# Testing

- Implementation
- The fun part!

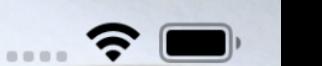


# Implementation in Swift



# Mini Demo

11:19



HOT DOG

11:16



NOT HOT DOG

# Training

# Training in Python

# Why Python?



# Why Python?

- Open Source
- Easy to Learn
- Readable
- It's Everywhere

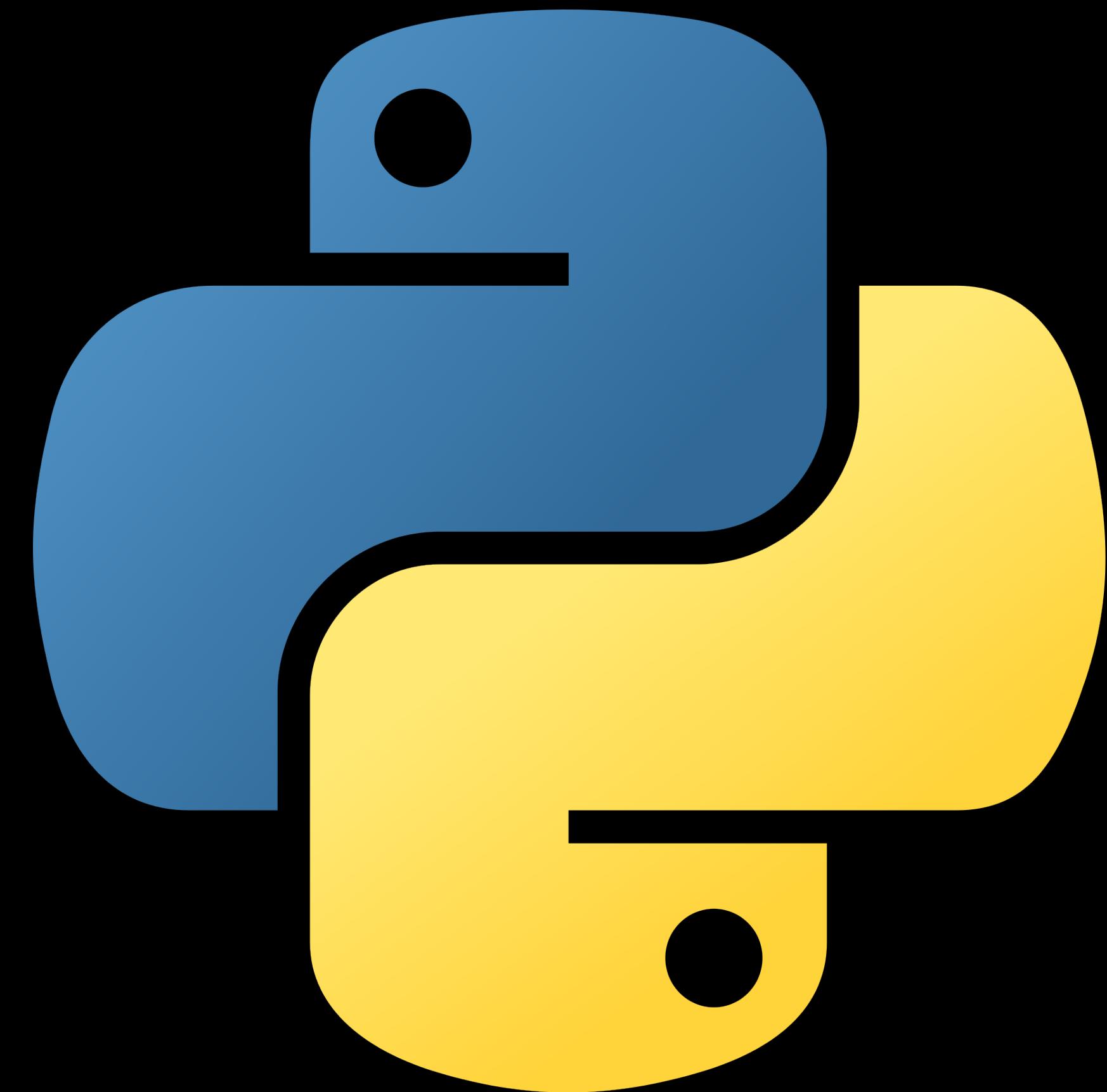


# Why NOT Python?

# Why Swift?

# High Level Programming

# High Level Programming



# High Level Programming

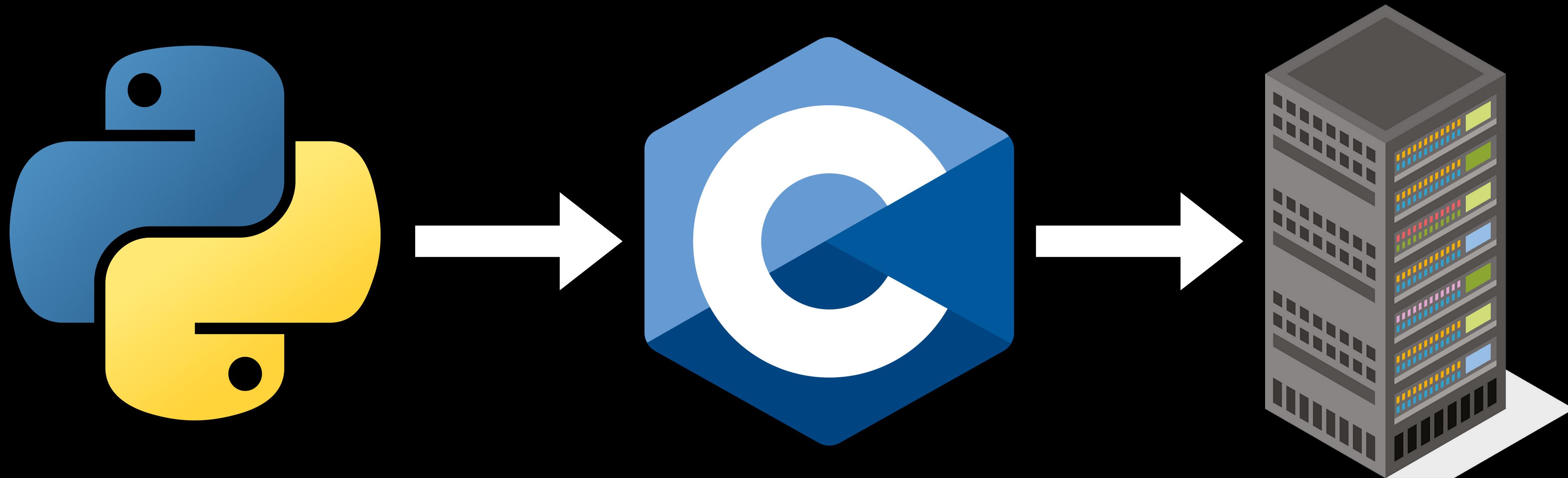


# High Level Programming



NumPy

# High Level Programming



# Why Swift?

**“I have this hope that there is a better way.  
Higher-level tools that actually let you see the  
structure of the software more clearly will be of  
tremendous value.”**

-Guido van Rossum

# Why Swift?

**“Swift is intended as a replacement for C-based languages (C, C++, and Objective-C).”**

[-swift.org](http://-swift.org)

# Why Swift?

**“Objective-C without the C”**

-Craig Federighi

# Why Swift?

- Swift is 8.4x Faster than Python
- Python is interpreted not compiled
- Source: Apple

Better performance  
equals better apps.

Swift apps more than live up to the name.  
For instance, a common search algorithm  
completes much faster using Swift.

Up to

2.6x

faster than  
Objective-C

Up to

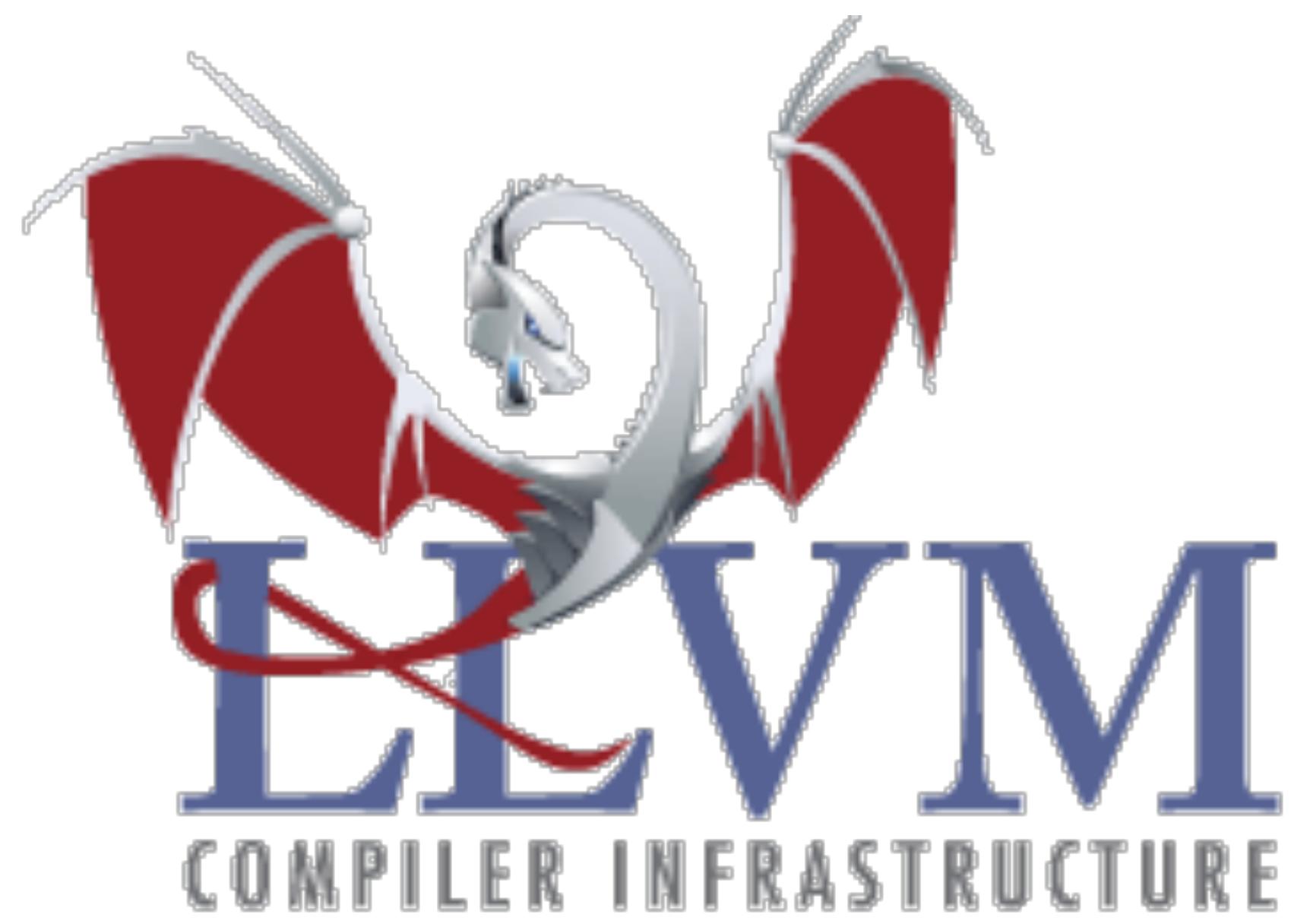
8.4x

faster than  
Python 2.7

10,000 integers found in a graph  
using depth-first search algorithm\*

# Optimization

# Swift and LLVM



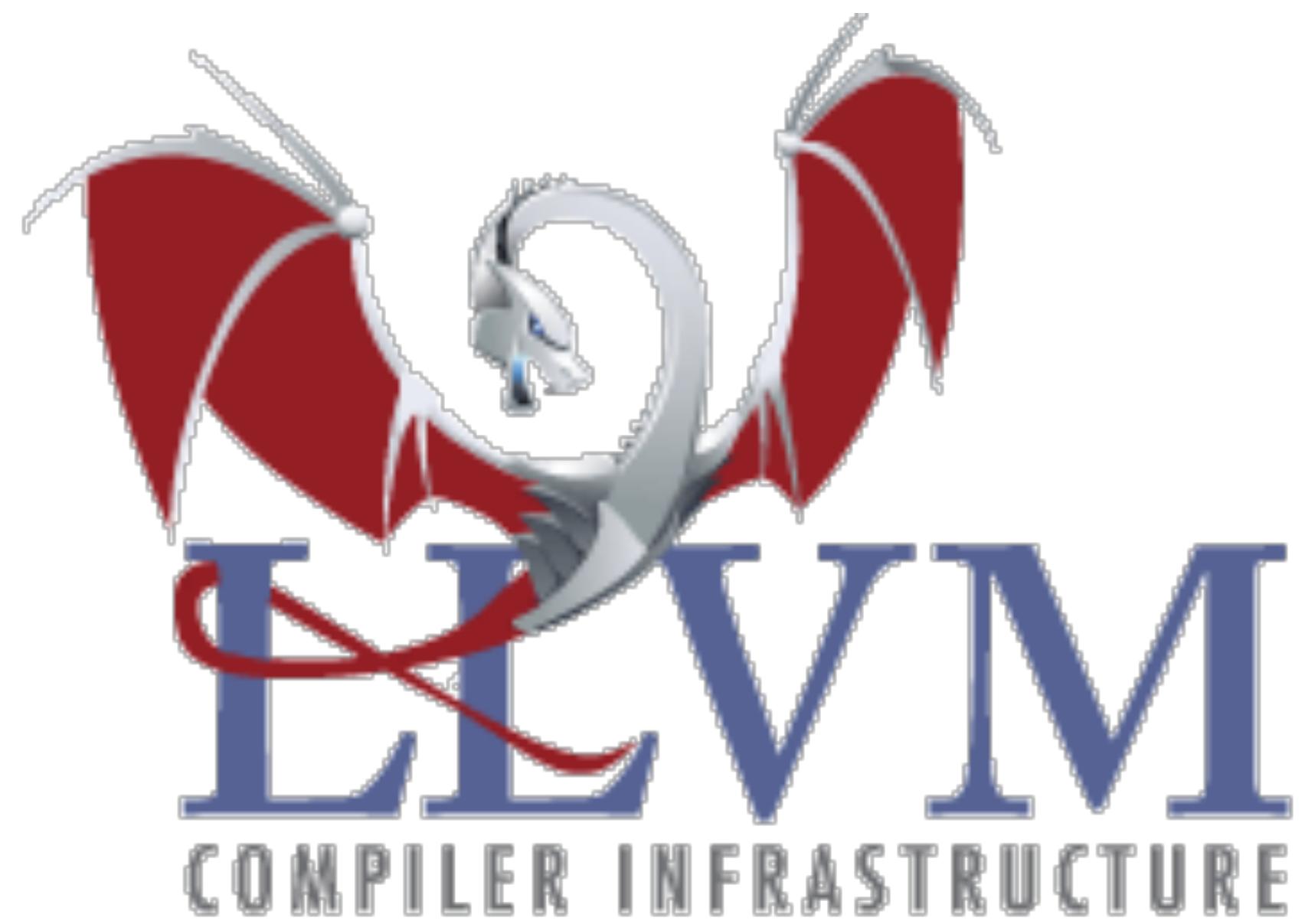
# Swift and LLVM

- Created by Chris Lattner



# Swift and LLVM

- Created by Chris Lattner
- Interoperable with C



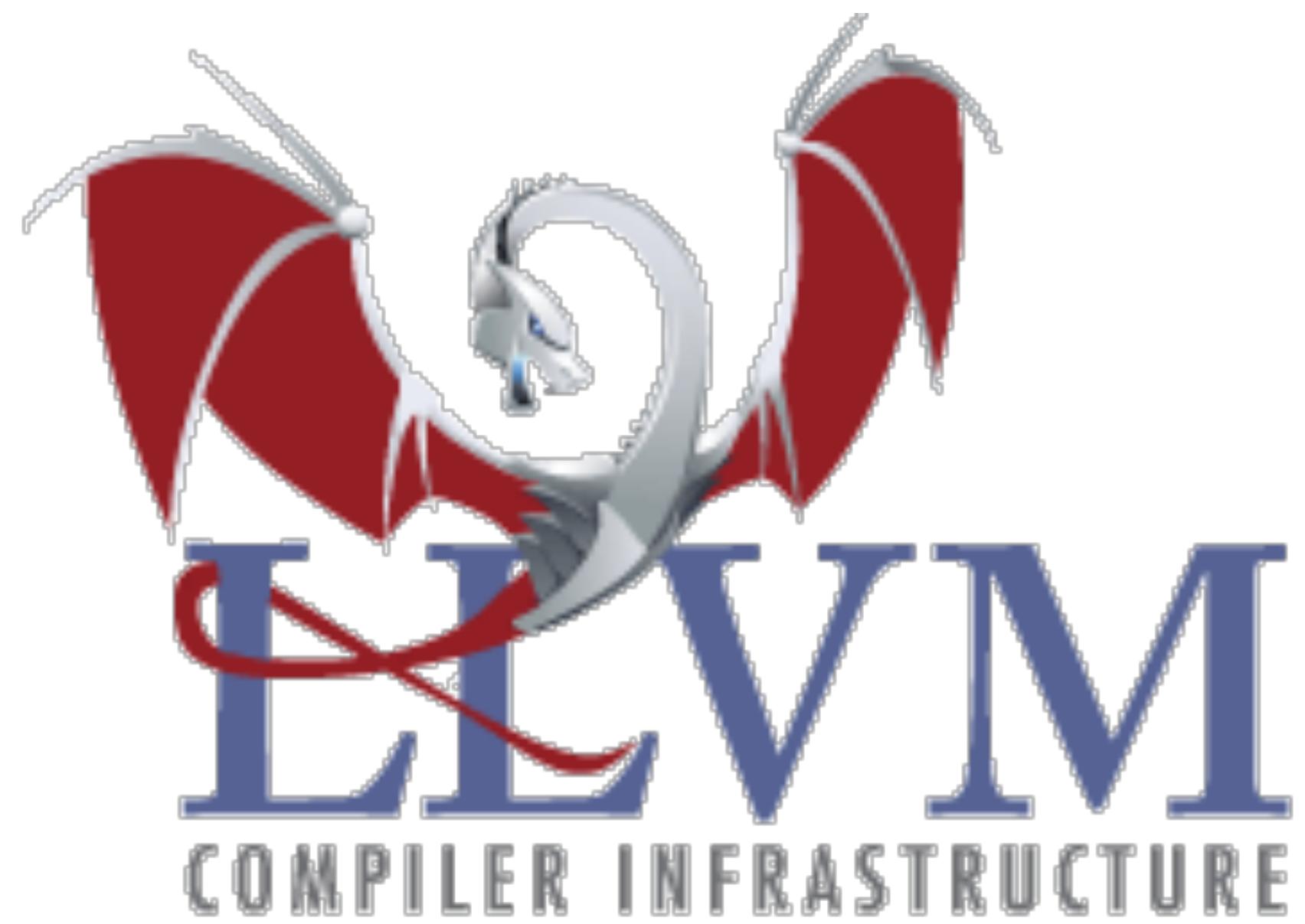
# Swift and LLVM

- Created by Chris Lattner
- Interoperable with C
- Facilitates computationally intensive programs in Swift



# Swift and LLVM

- Created by Chris Lattner
- Interoperable with C
- Facilitates computationally intensive programs in Swift
- Has an awesome logo



# Parallel Computation

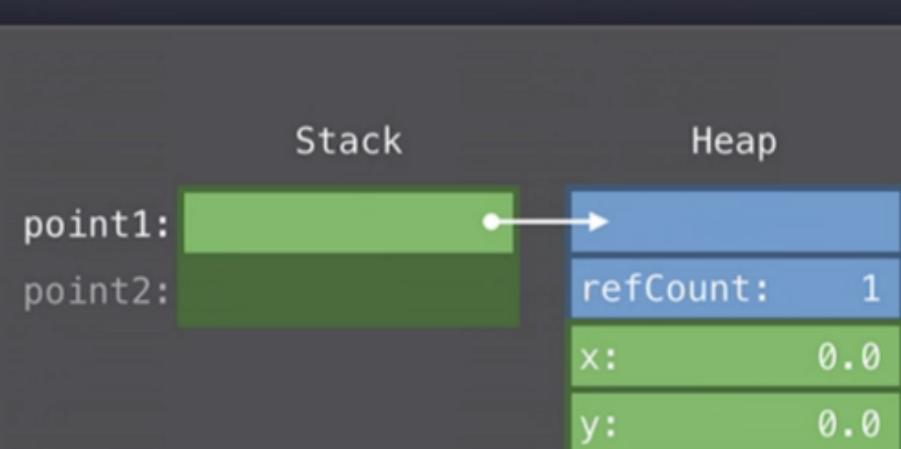
# Swift Reference Types

- Value types store in Stack
  - Reference types store in Heap,  
with addresses in Stack
  - Reference Counts must be  
recorded

```
// Reference Counting
// Class (generated code)

class Point {
    var refCount: Int
    var x, y: Double
    func draw() { ... }
}
```

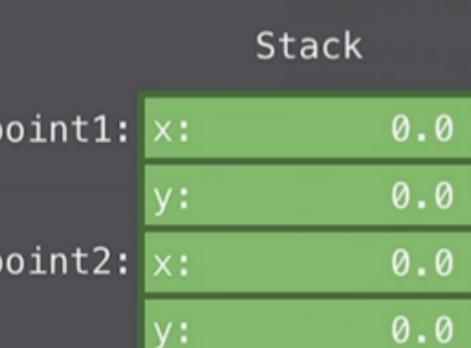
```
let point1 = Point(x: 0, y: 0)
let point2 = point1
retain(point2)
point2.x = 5
// use `point1`
release(point1)
// use `point2`
release(point2)
```



```
// Allocation
// Struct

struct Point {
    var x, y: Double
    func draw() { ... }
}
```

```
let point1 = Point(x: 0, y: 0)  
var point2 = point1  
  
point2.x = 5  
// use `point1`  
// use `point2`
```



# My Personal Grievances

# Dynamic Typing

# No Brackets

# Why Swift?

# Dynamic Typing

Resolved.

# No Brackets

Resolved.

# Innovations

# Swift for TensorFlow





**“All drains lead to the ocean”**

-Finding Nemo

# Core ML



# Core ML



# Create ML

- Minimizes Code (if you're into that sort of thing)
- Fast and Optimized
- Limited Use Cases



# Cooler Mini Demo

Choose a Template

- All
- New
- Image
- Video
- Motion
- Sound
- Text
- Table

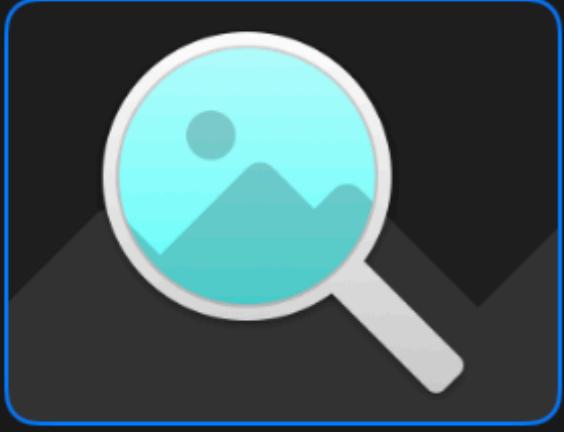
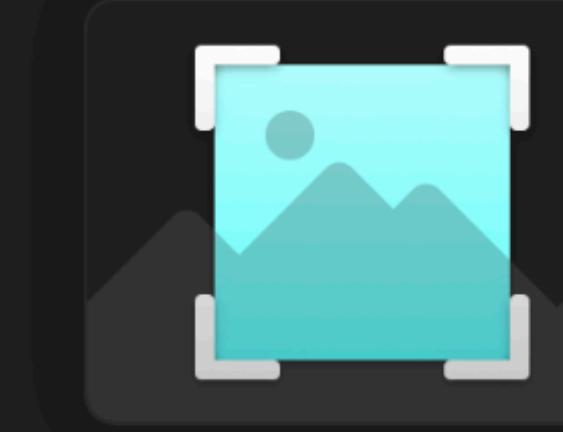


Image Classification



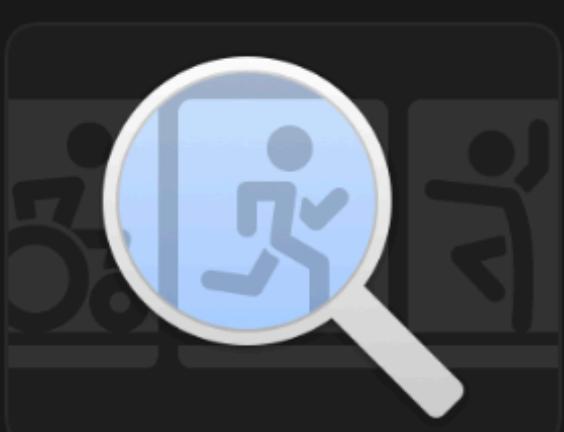
Object Detection



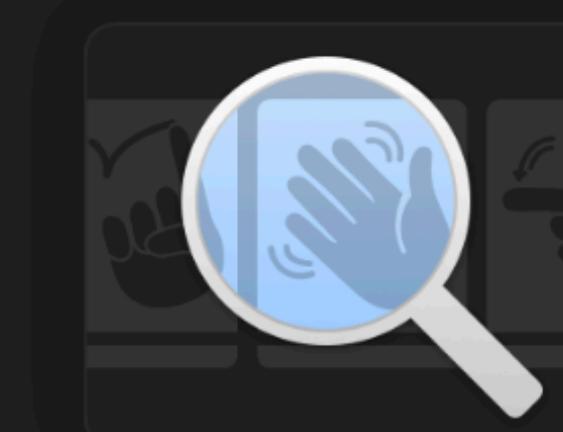
Style Transfer



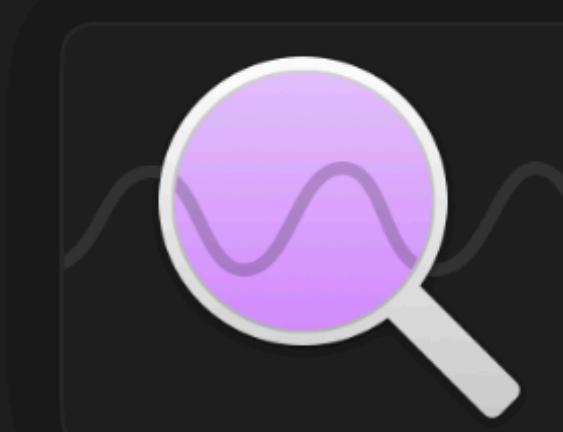
Hand Pose Classification



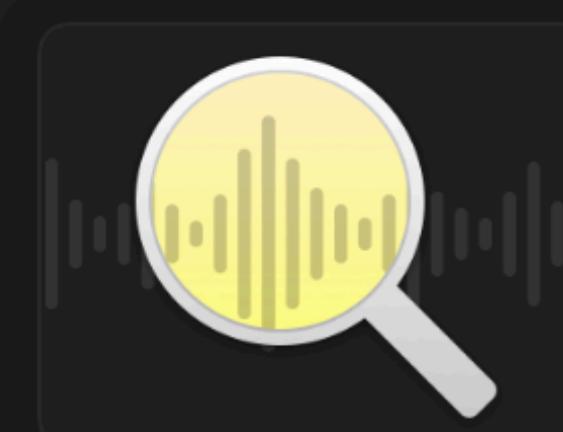
Action Classification



Hand Action Classification



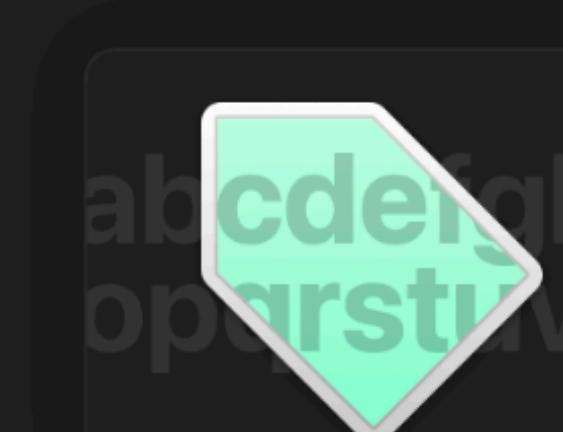
Activity Classification



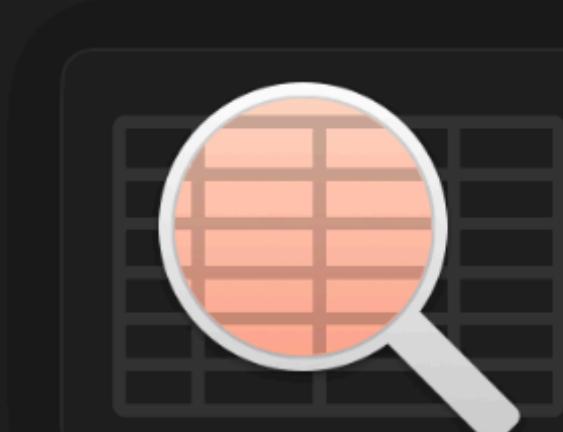
Sound Classification



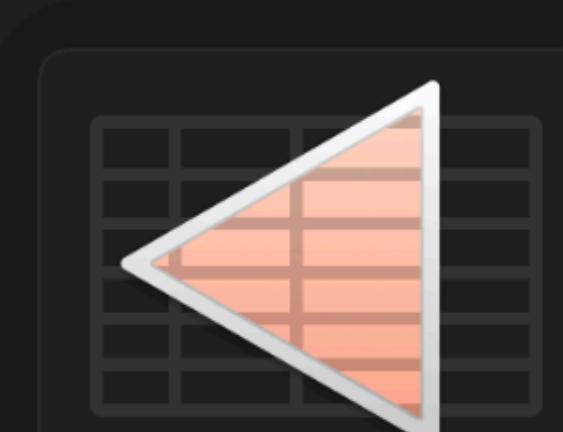
Text Classification



Word Tagging



Tabular Classification



Tabular Regression

**Image Classification**  
Classify the dominant object or scene in an image.

Cancel Previous Next

Project Name **HotDogClassifier**

Author **Ben Poothi**

License **No license provided**

Description **An image classification machine learning model that recognizes hot dogs and things that are not hot dogs.**

**Cancel** **Previous** **Next**

Project

HotDogClassifier

Model Sources +

HotDogClassifier 1

Data Sources

No Data Sources

Train

Settings Training Evaluation Preview Output

Activity

Data

Training Data

Validation Data

Testing Data

Choose

Automatic

None

Parameters

Iterations 25

Augmentations

- Add Noise
- Blur
- Crop
- Expose
- Flip
- Rotate

Training Validation Testing

Activity May 2, 2023

Model Source Created 11:36 AM

HotDogClassifier 1

Project Created 11:36 AM

HotDogClassifier

Training data required

# Create ML

- Minimizes Code (if you're into that sort of thing)
- Fast and Optimized
- Limited Use Cases



# Special Thanks To...

- The Deep Dish Swift Team
- Swift.org
- Apple Developer
- Python Software Foundation
- Philipp Muens
- Lex Fridman



Thank You.