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## Summary

Lak Lakshmanan

# Machine Learning on Google Cloud Platform

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The Art of ML

Hyperparameter Tuning

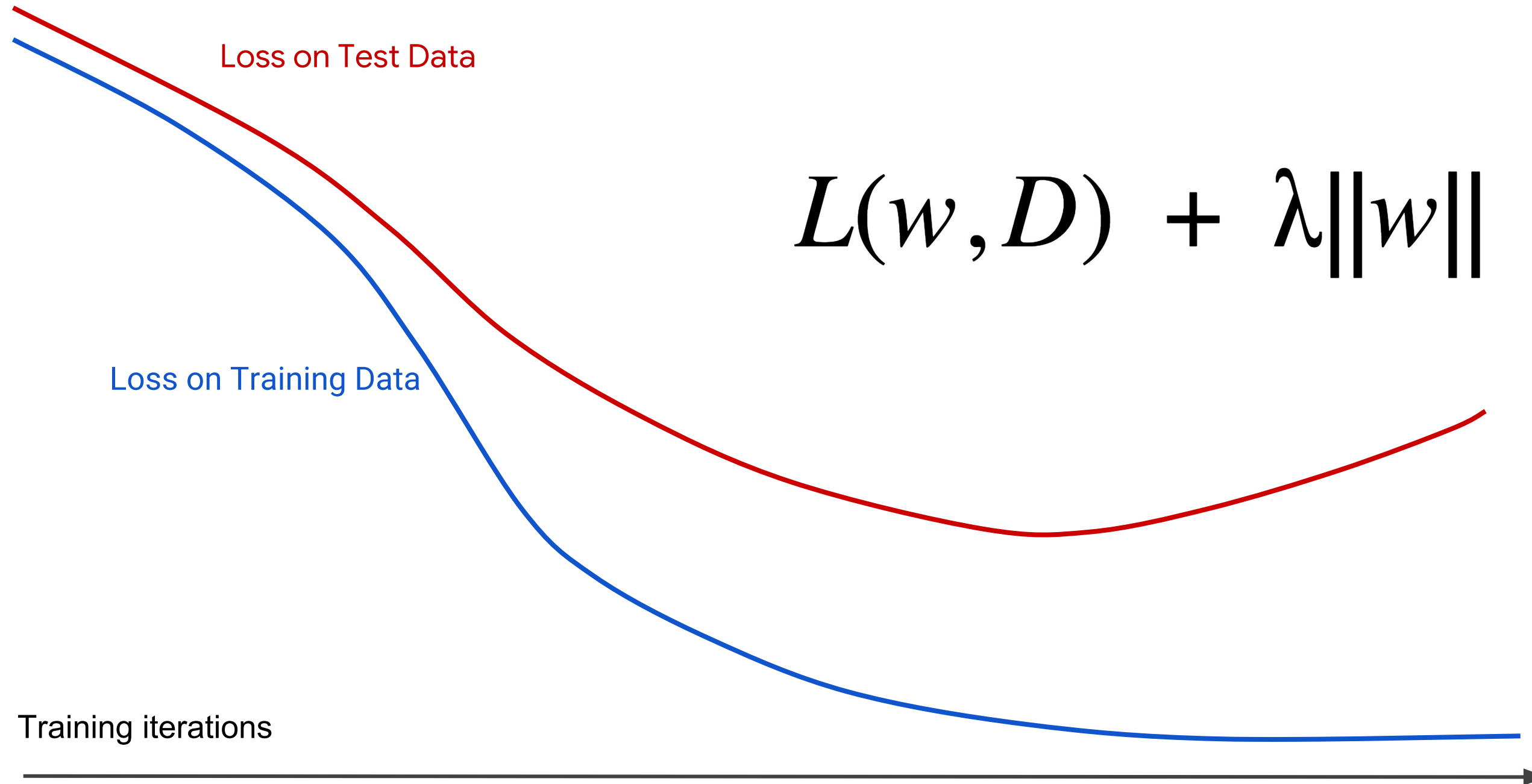
A Pinch of Science

The Science of Neural Networks

Embeddings

Custom Estimator

# The art of ML: regularization



# The art of Machine Learning

Batch size and learning rate have a strong impact on training



**Batch size too small** - training will bounce around

**Batch size too large** - training will take a very long time

**Learning rate too small** - training will take a long time

**Learning rate too large** - training will bounce around

# Hyperparameter Tuning

There are a variety of model parameters

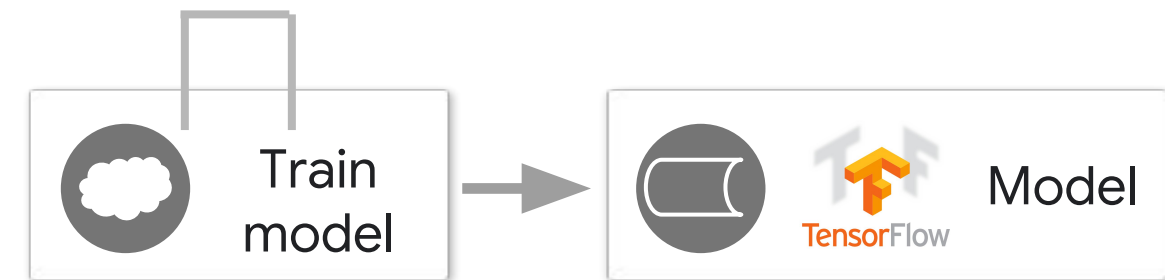
Size of model

Number of hash buckets

Embedding size

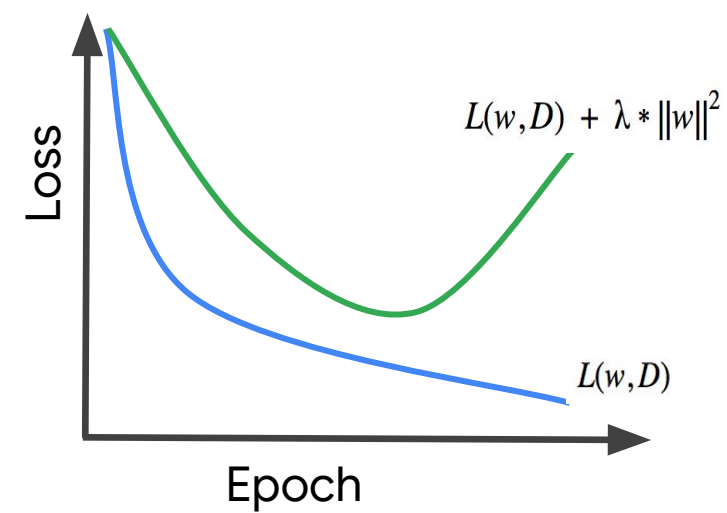
Etc.

Hyper-parameter  
tuning

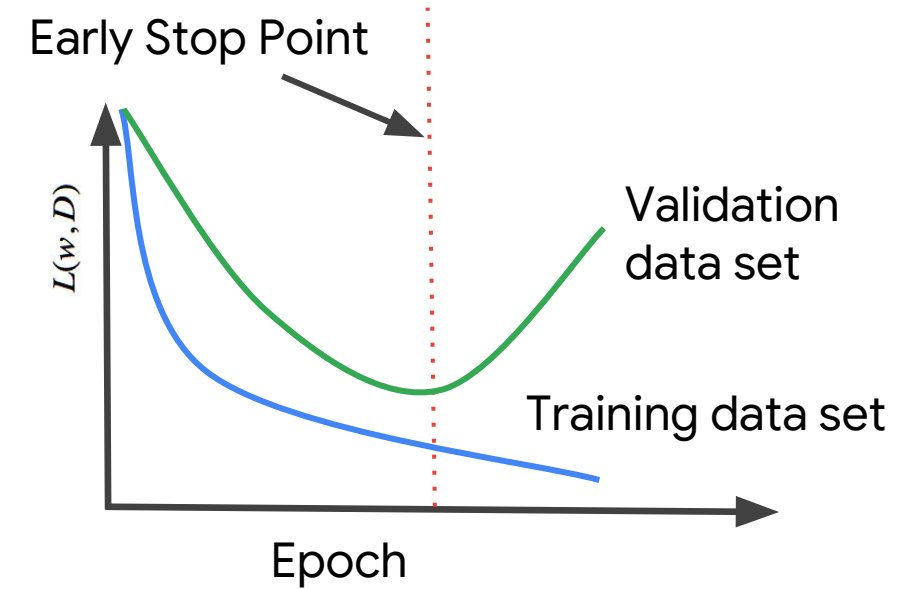


# A pinch of science

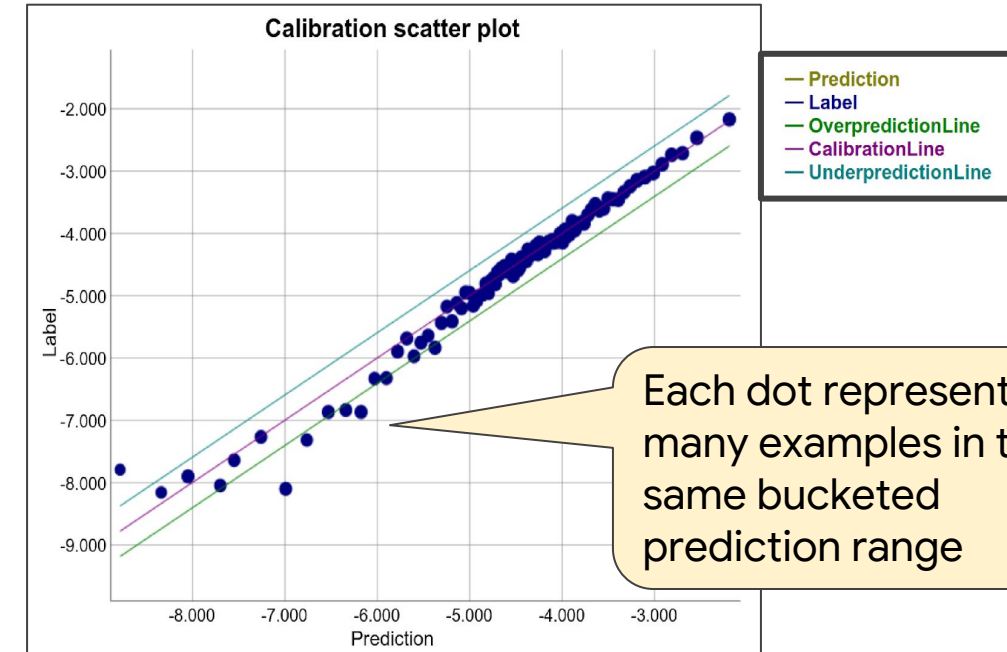
## Regularization



## Early stopping

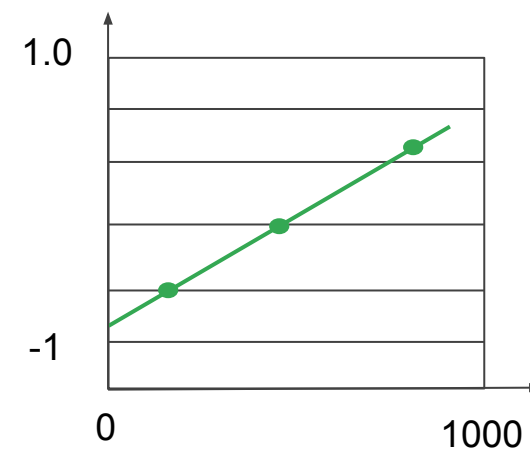


Calibration scatter plot

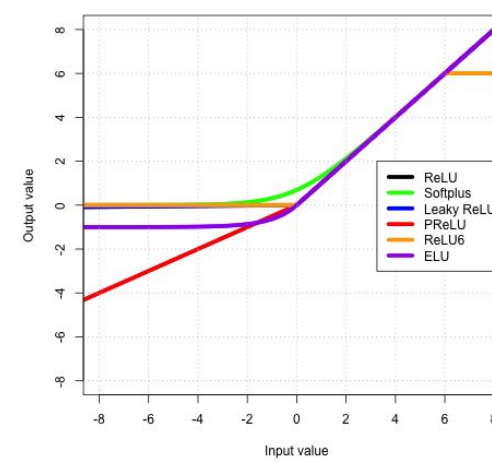


# Making neural networks converge faster and better

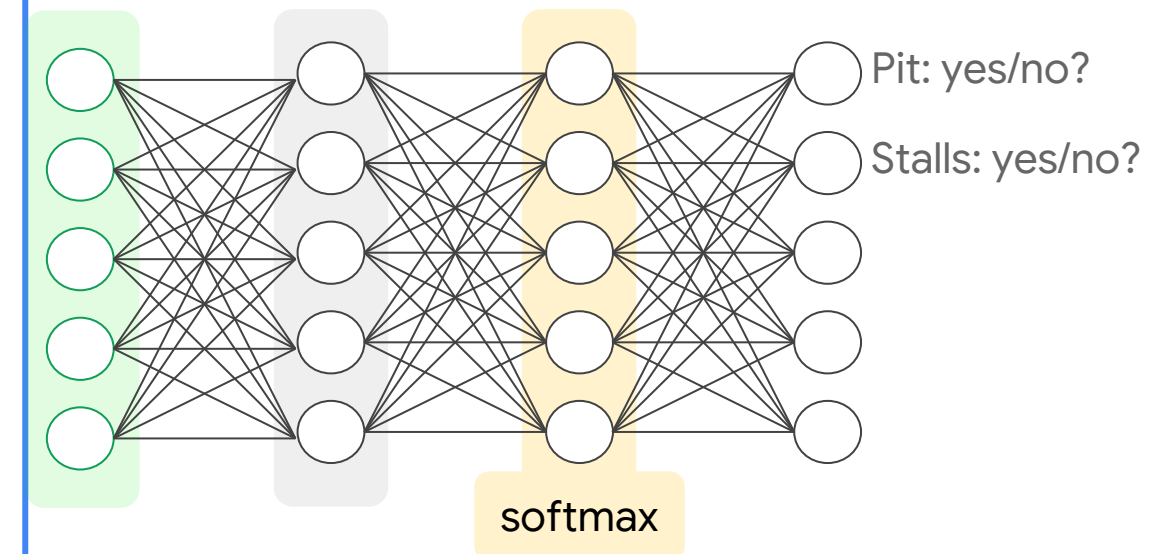
## Linear scaling




## ReLU variants



## Reducing computation

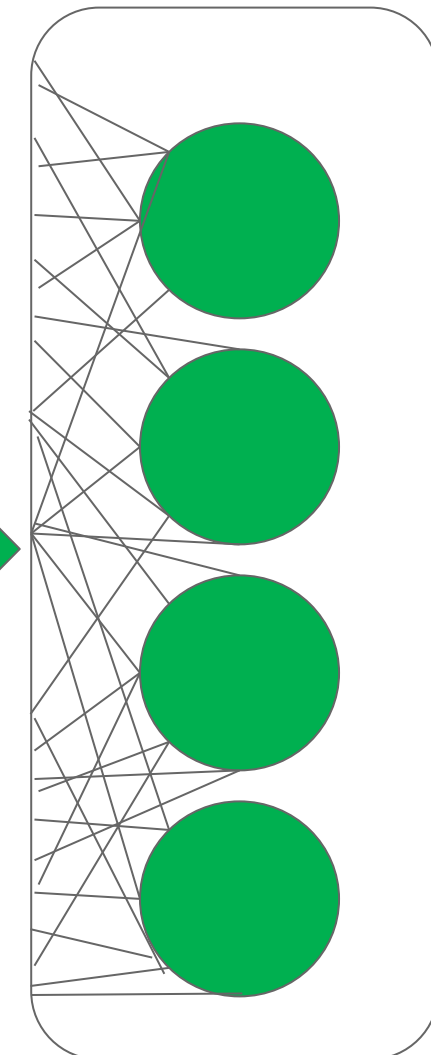
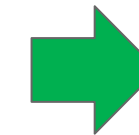


# Code to create an embedded feature column in TensorFlow

Example	movieId
0	
1	
2	
3	
4	



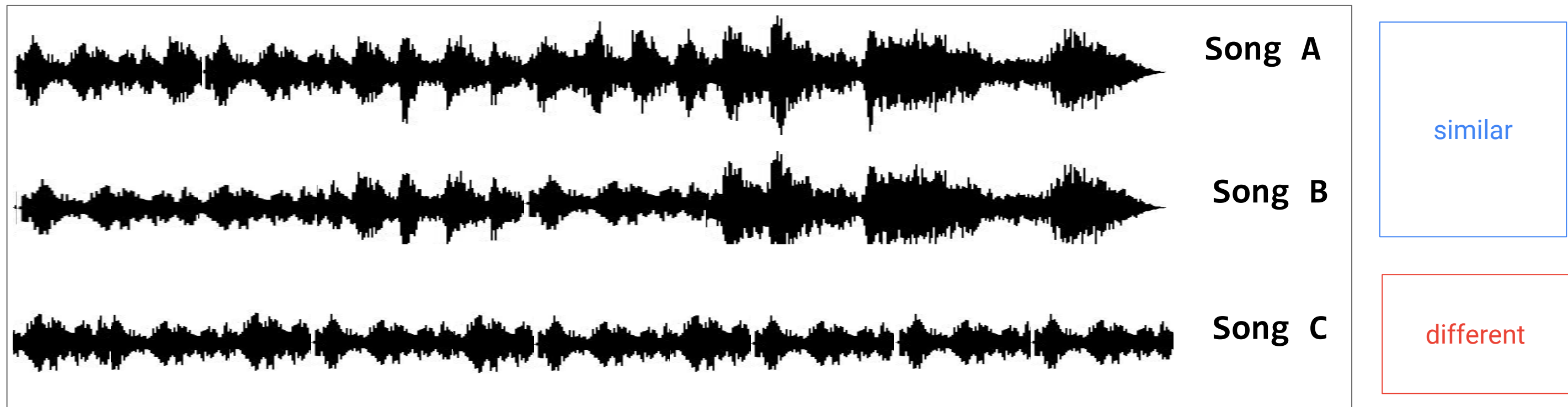
#	Shrek	Incredible	Triplets ...	Harry Potter	Star Wars
0	1	0	0	0	0
1	0	1	0	0	0
2	0	0	1	0	0
3	0	0	0	1	0
4	1	0	0	0	0



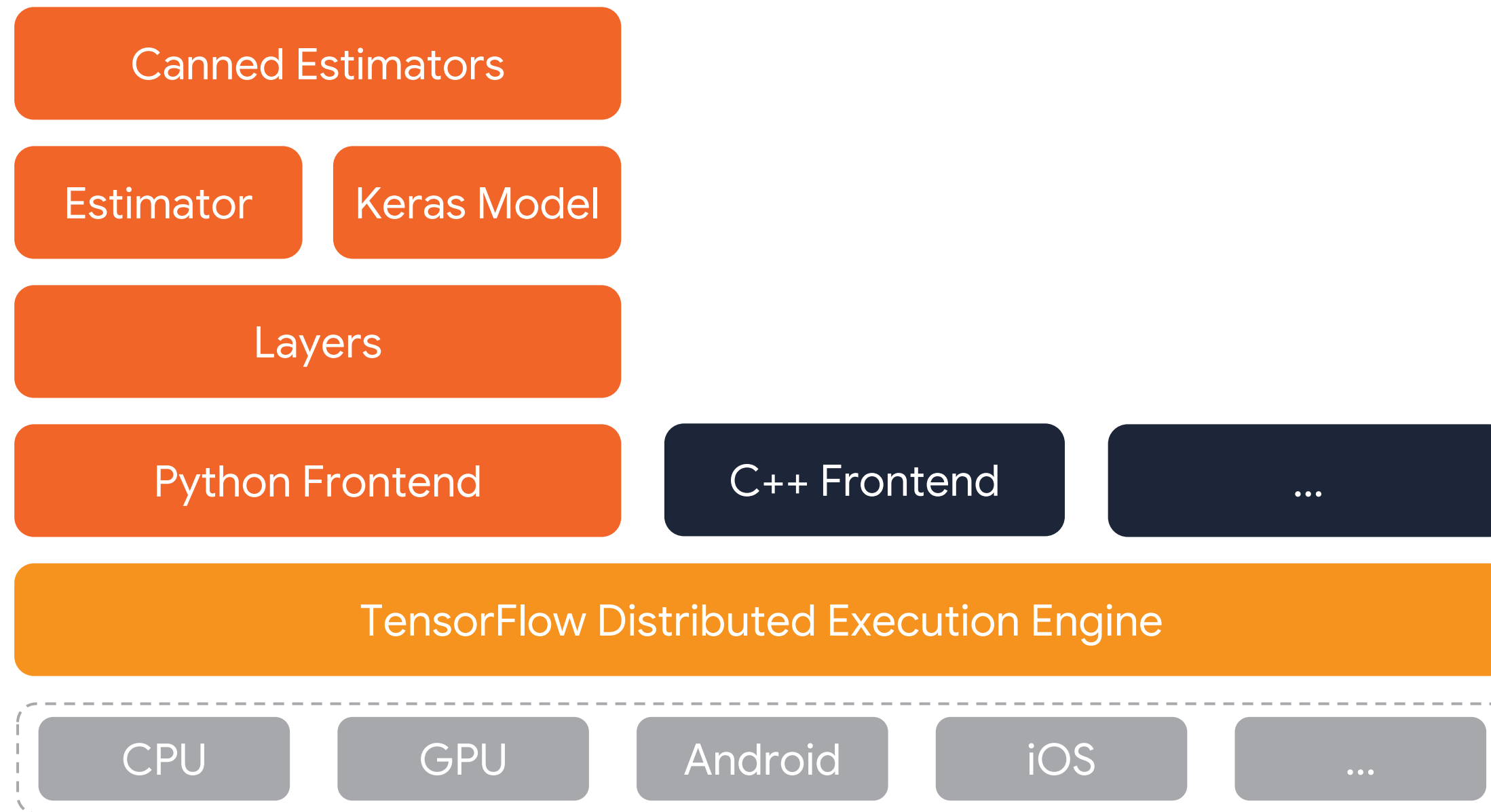
```
sparse_movie = fc.categorical_column_with_vocabulary_list(  
    'movieId', vocabulary_list=[...])  
embedded_movie = fc.embedding_column(sparse_movie, 100)
```



# You can take advantage of this similarity property of embeddings



# Canned Estimators are sometimes insufficient



# Objectives

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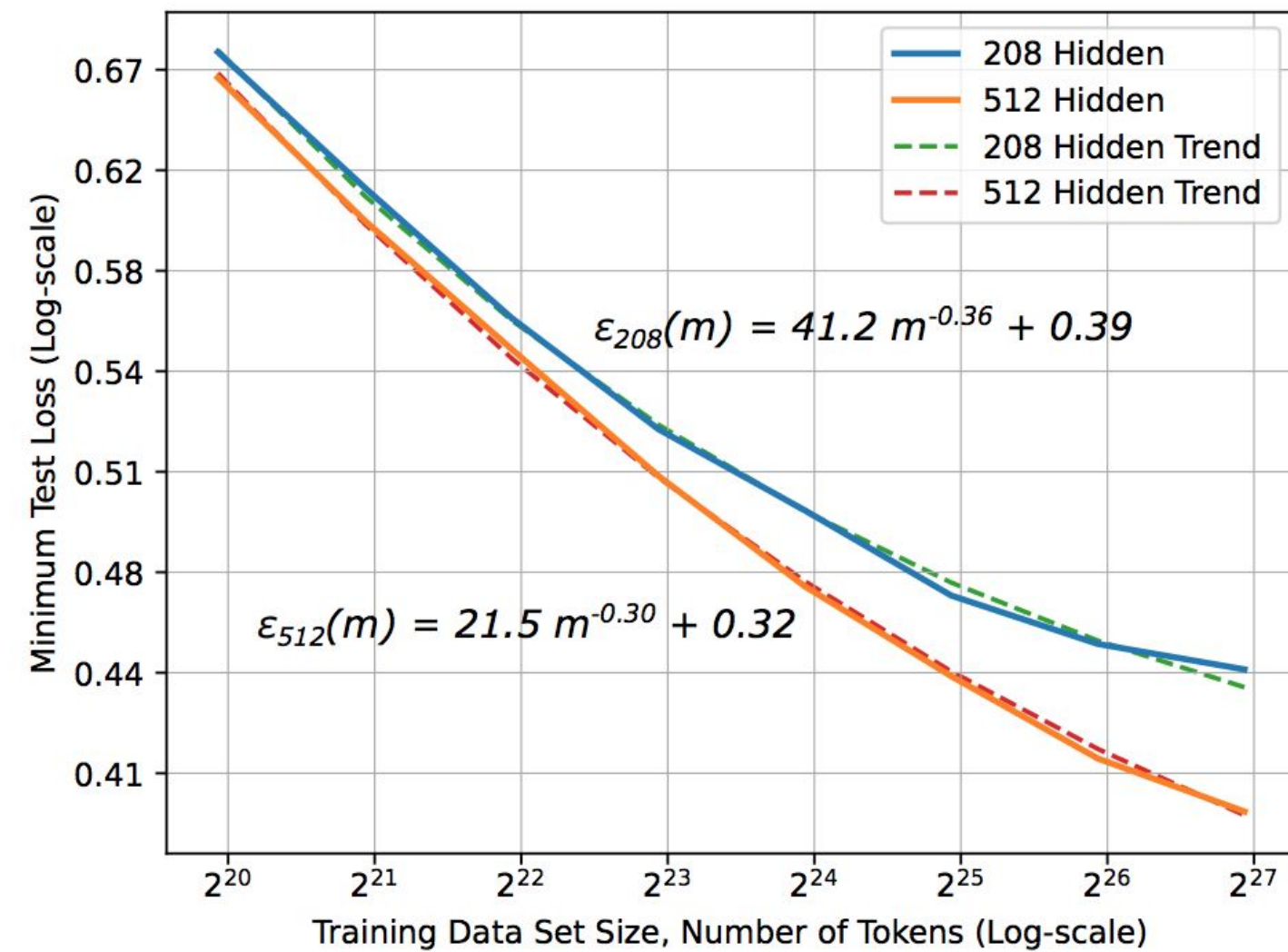
Why ML?

ML with TensorFlow

Improving ML Accuracy

ML at Scale

Specialized ML Models



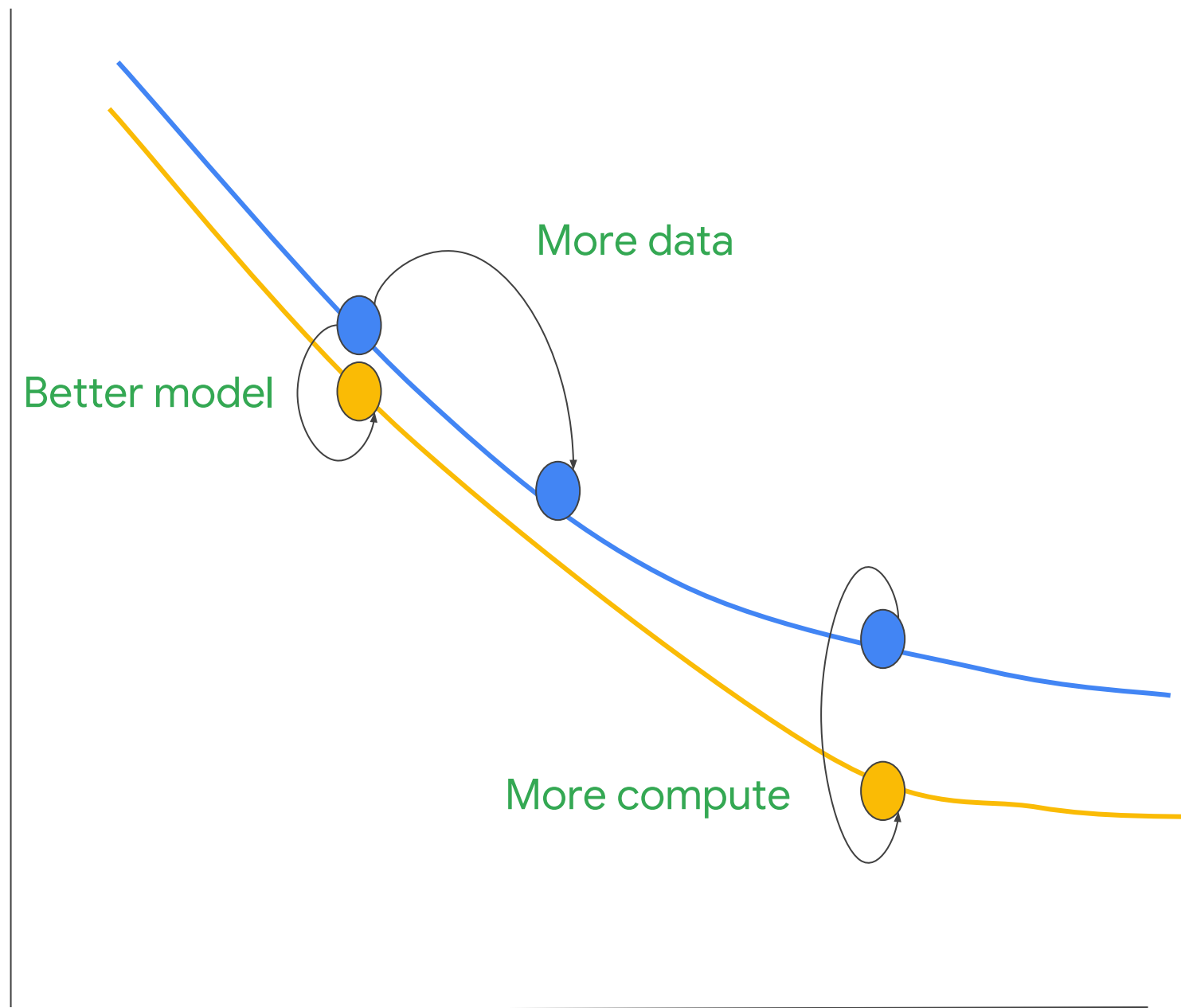
The unreasonable effectiveness of data

<https://static.googleusercontent.com/media/research.google.com/en//pubs/archive/35179.pdf>

Deep Learning scaling is predictable, empirically

<https://arxiv.org/abs/1712.00409>

Invest in data collection, augmentation and enrichment; then top off with hyperparameter tuning



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