Practical ML Tutorial: Part I

—

George Williams

Workshop Collaborators

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Graduate Research Assistant
UT Chattanooga

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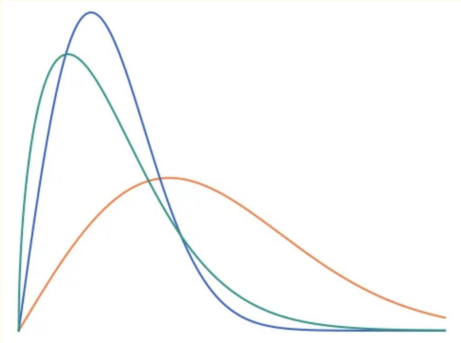
Graduate Research Assistant
UT Chattanooga

SEE MAPLD

Agenda

Part I

- AI Trends
- ML Basics
- Survival Analysis
- *Hands-On Programming*



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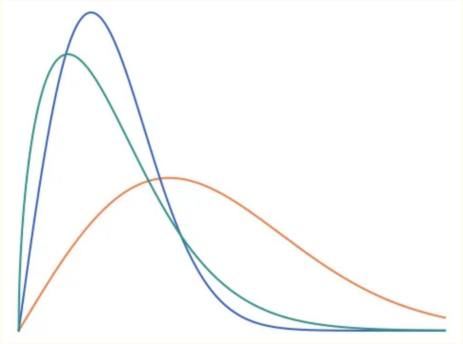


Part II

- AI Hardware
- FastAI and Pytorch Basics
- Computer Vision
- *Hands-On Programming*

Hands-On

- Use contemporary software tools
- Web-based
- Tactile learning
- With Caveats...

Workshop Hardware

Workshop Software

https://github.com/sourcesync/seemap2003

SEE MAPLD

AI Trends

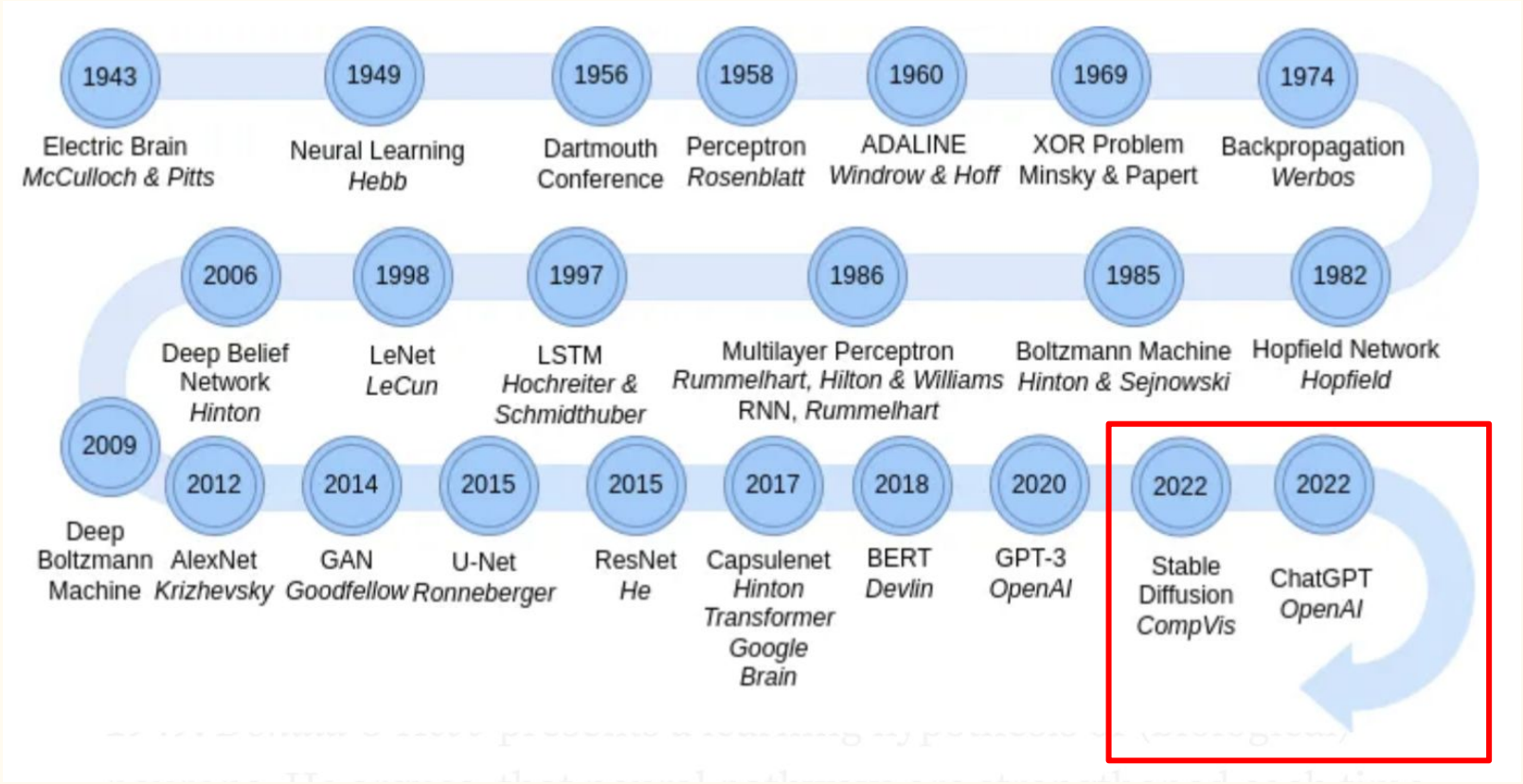
- ChatGPT
- Stable Diffusion
- Deep Fakes
- Alpha Fold
- Foundation Models

OpenAI
ChatGPT

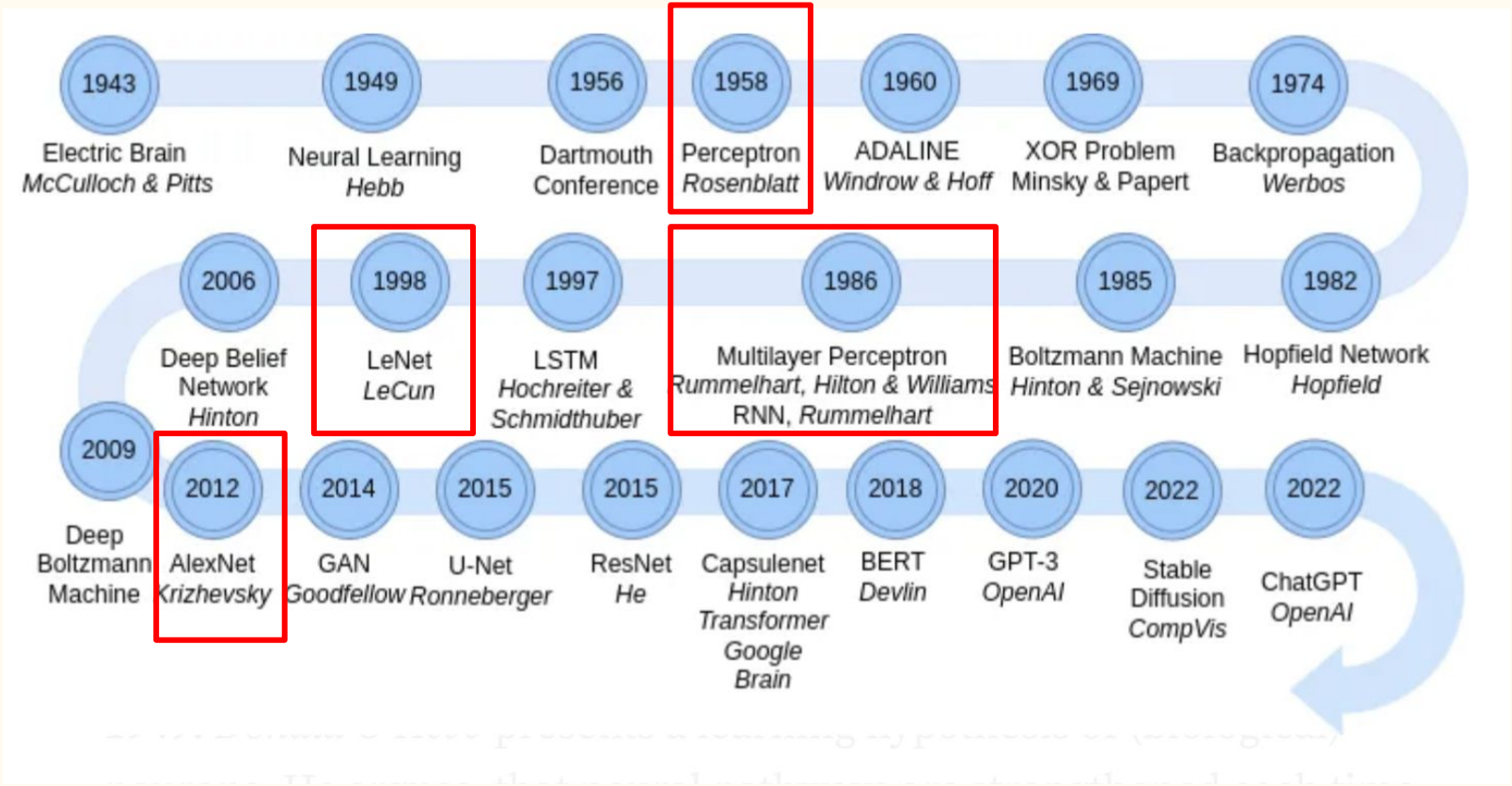
STABLE DIFFUSION
DALLE 2
MIDJOURNEY

nature
DeepMind

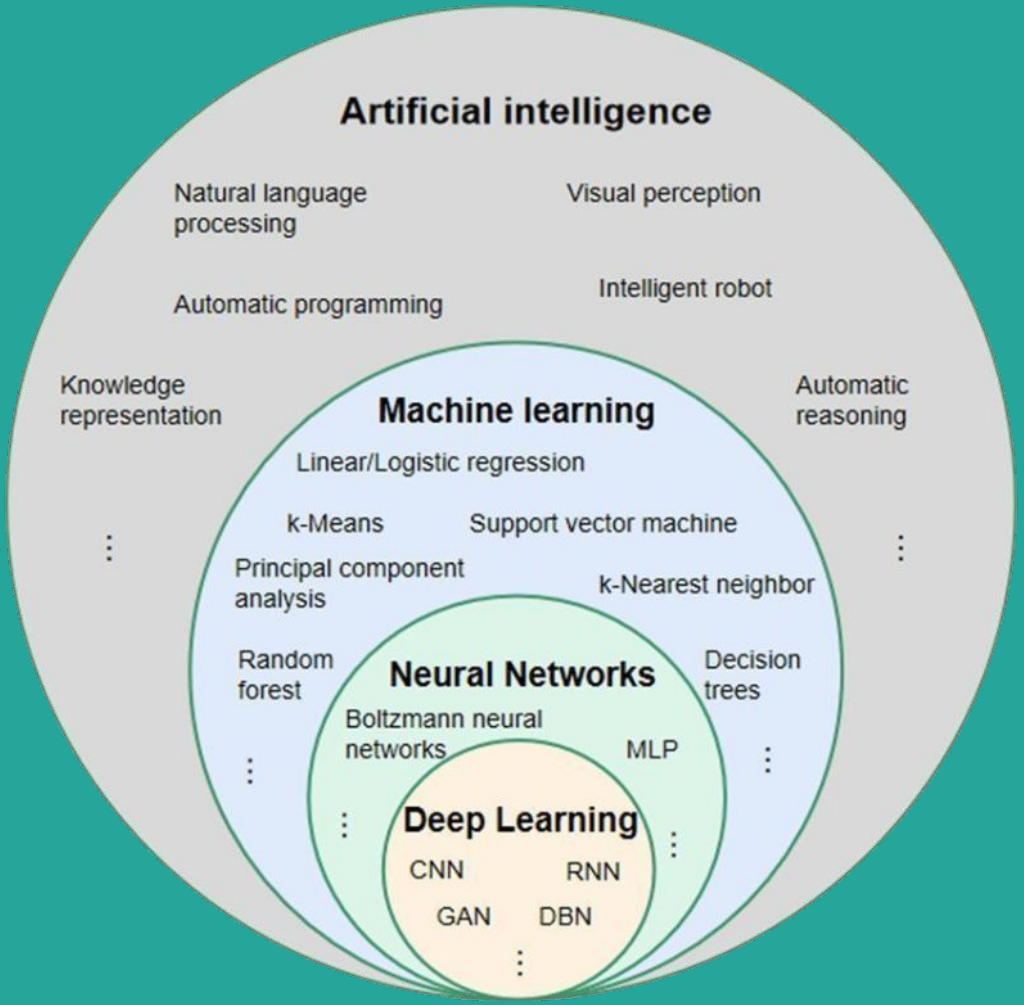
Neural Networks



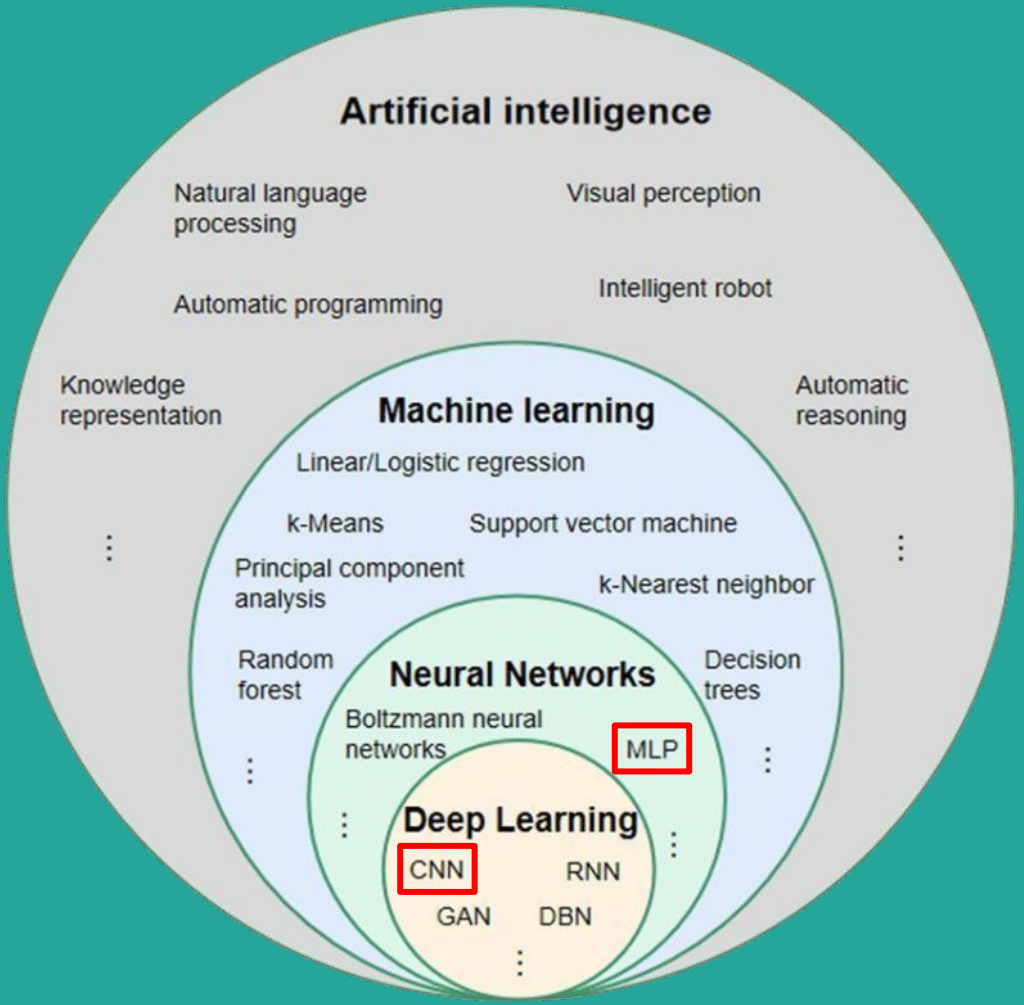
Neural Networks



ML


Artificial intelligence
Natural language processing
Visual perception
Automatic programming
Intelligent robot
Knowledge representation
Automatic reasoning
Machine learning
Linear/Logistic regression
k-Means
Support vector machine
Principal component analysis
k-Nearest neighbor
Random forest
Decision trees
Neural Networks
Boltzmann neural networks
MLP
Deep Learning
CNN
RNN
GAN
DBN

ML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Principal component analysis
k-Nearest neighbor
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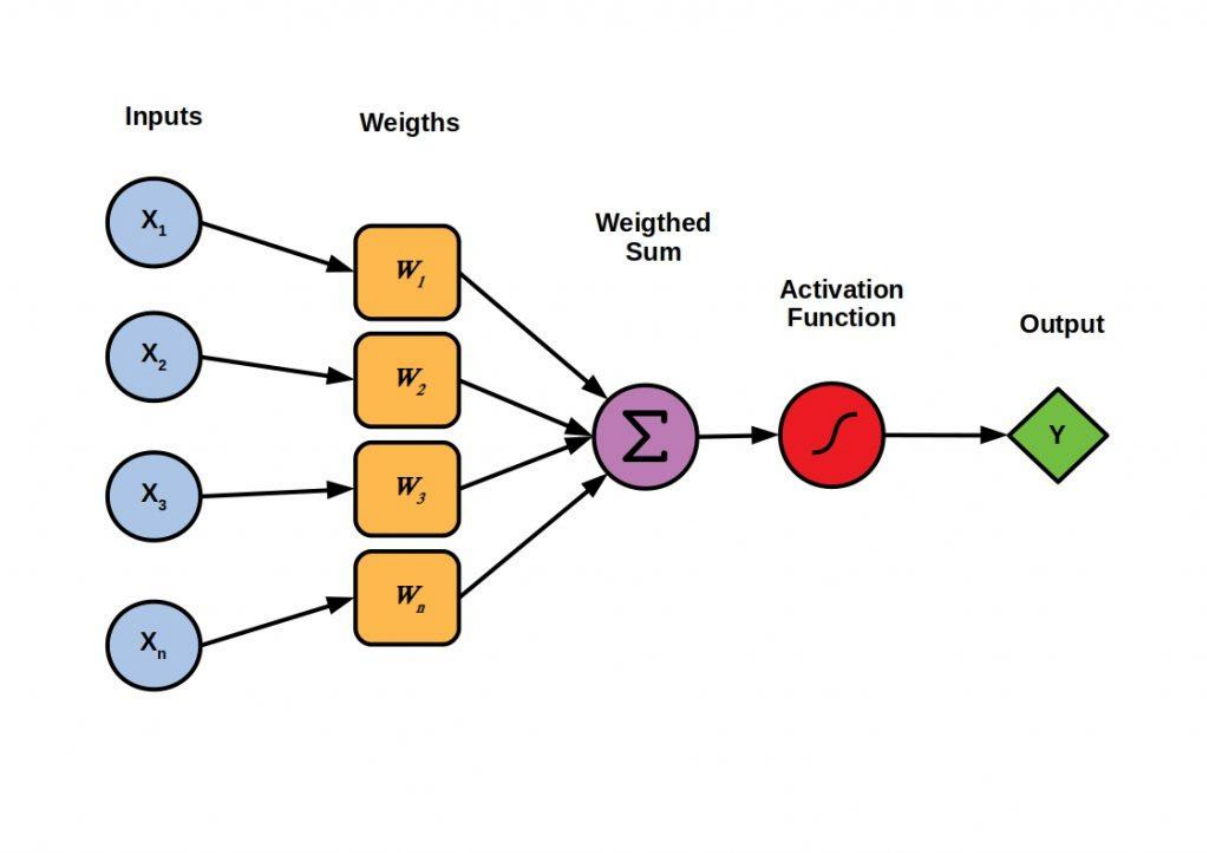
Neural Network Basics

Neural Networks Basic Unit



A mostly complete chart of

Neural Networks

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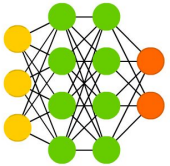
Perceptron (P)

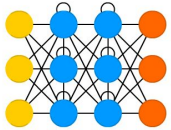
Feed Forward (FF)

Radial Basis Network (RBF)

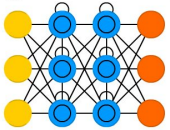
Deep Feed Forward (DFF)



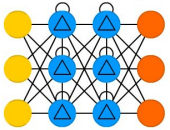
Recurrent Neural Network (RNN)



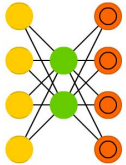
Long / Short Term Memory (LSTM)



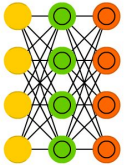
Gated Recurrent Unit (GRU)



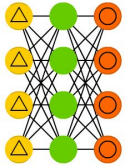
Auto Encoder (AE)



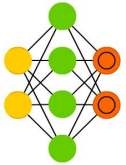
Variational AE (VAE)



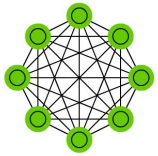
Denoising AE (DAE)



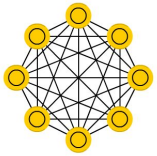
Sparse AE (SAE)



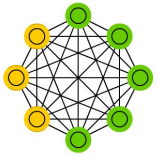
Markov Chain (MC)



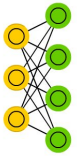
Hopfield Network (HN)



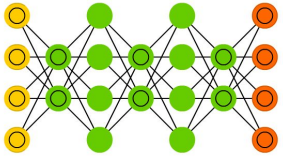
Boltzmann Machine (BM)



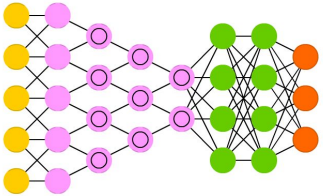
Restricted BM (RBM)



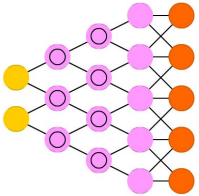
Deep Belief Network (DBN)



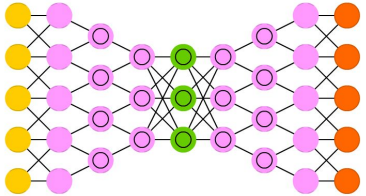
Deep Convolutional Network (DCN)



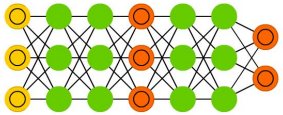
Deconvolutional Network (DN)



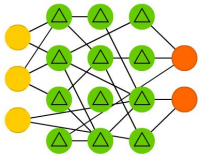
Deep Convolutional Inverse Graphics Network (DCIGN)



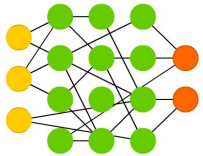
Generative Adversarial Network (GAN)



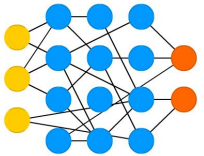
Liquid State Machine (LSM)



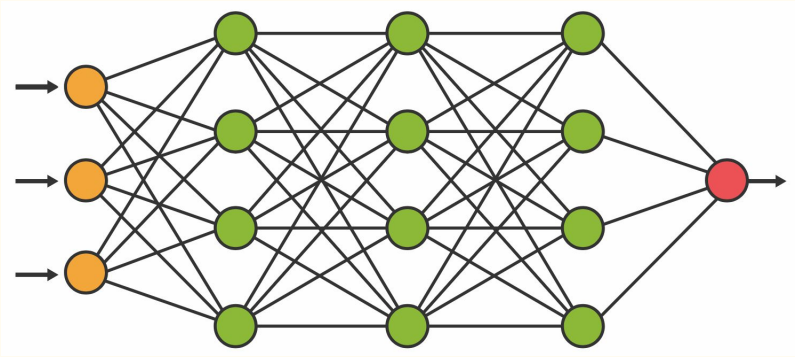
Extreme Learning Machine (ELM)



Echo State Network (ESN)



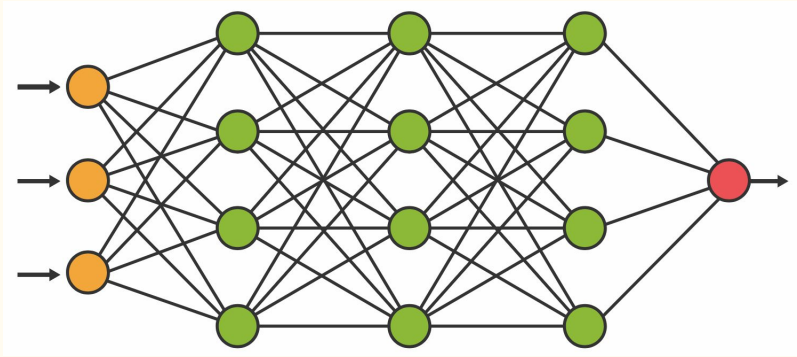
Neural Networks “In Practice”



Model

Neural Networks “In Practice”

Data

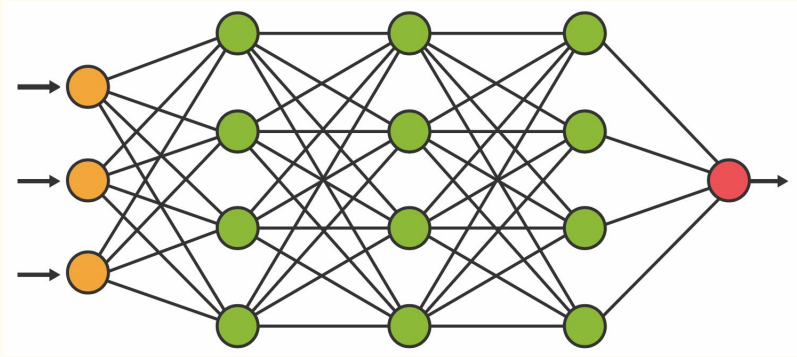


Model

Eval

Neural Networks “In Practice”

Data

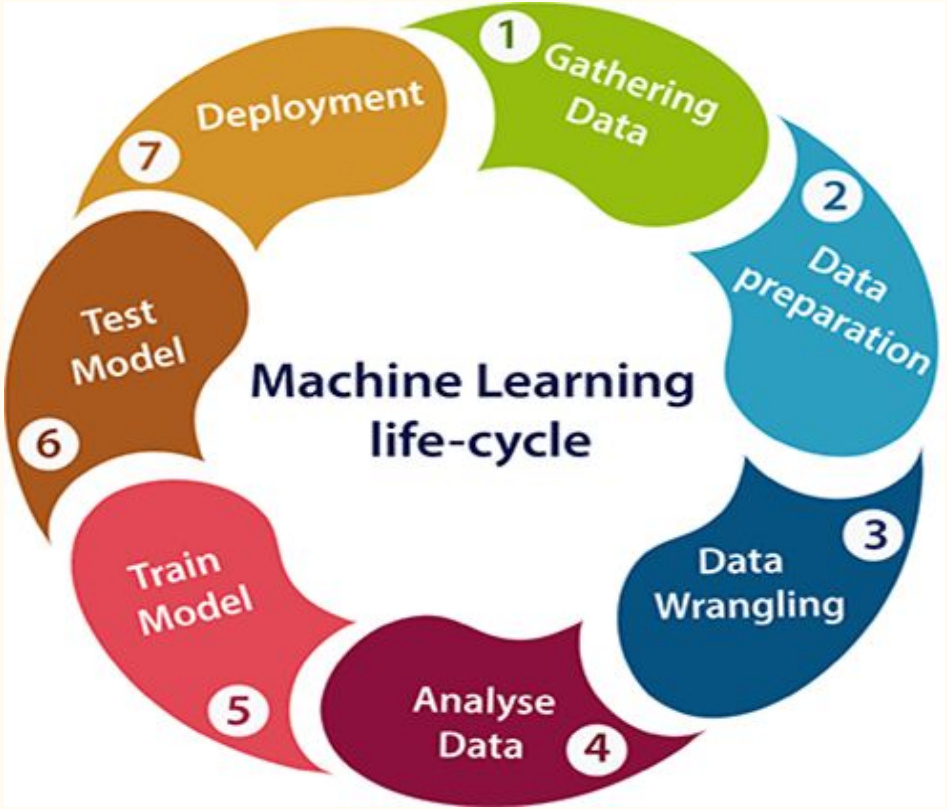


Model

Eval

Learning Algorithm

Neural Networks “In Practice”



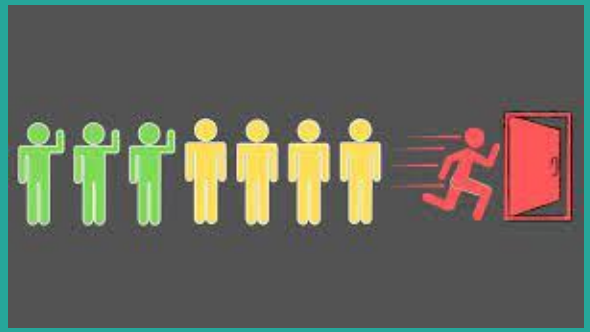
Survival Analysis

Tries To Answer The Question:

When Will It End?

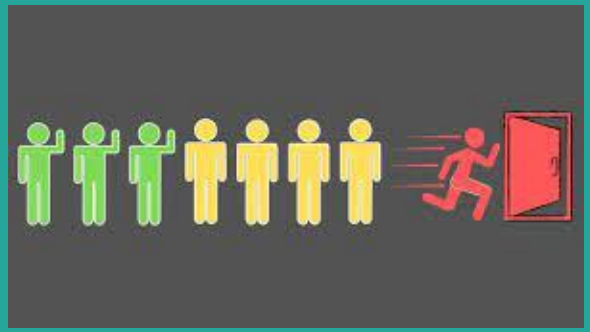
When Will It End?

When Will It End?



Customer Churn

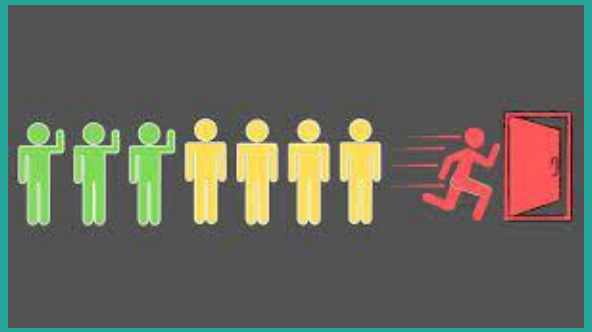
When Will *It* End?



Customer Churn

Health Outcomes

When Will *It* End?

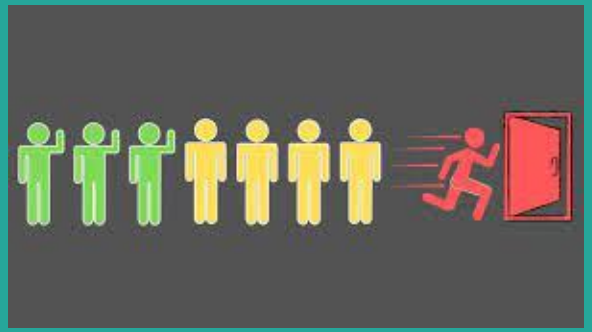


Customer Churn

Health Outcomes

Machine Failure

When Will *It* End?



Customer Churn

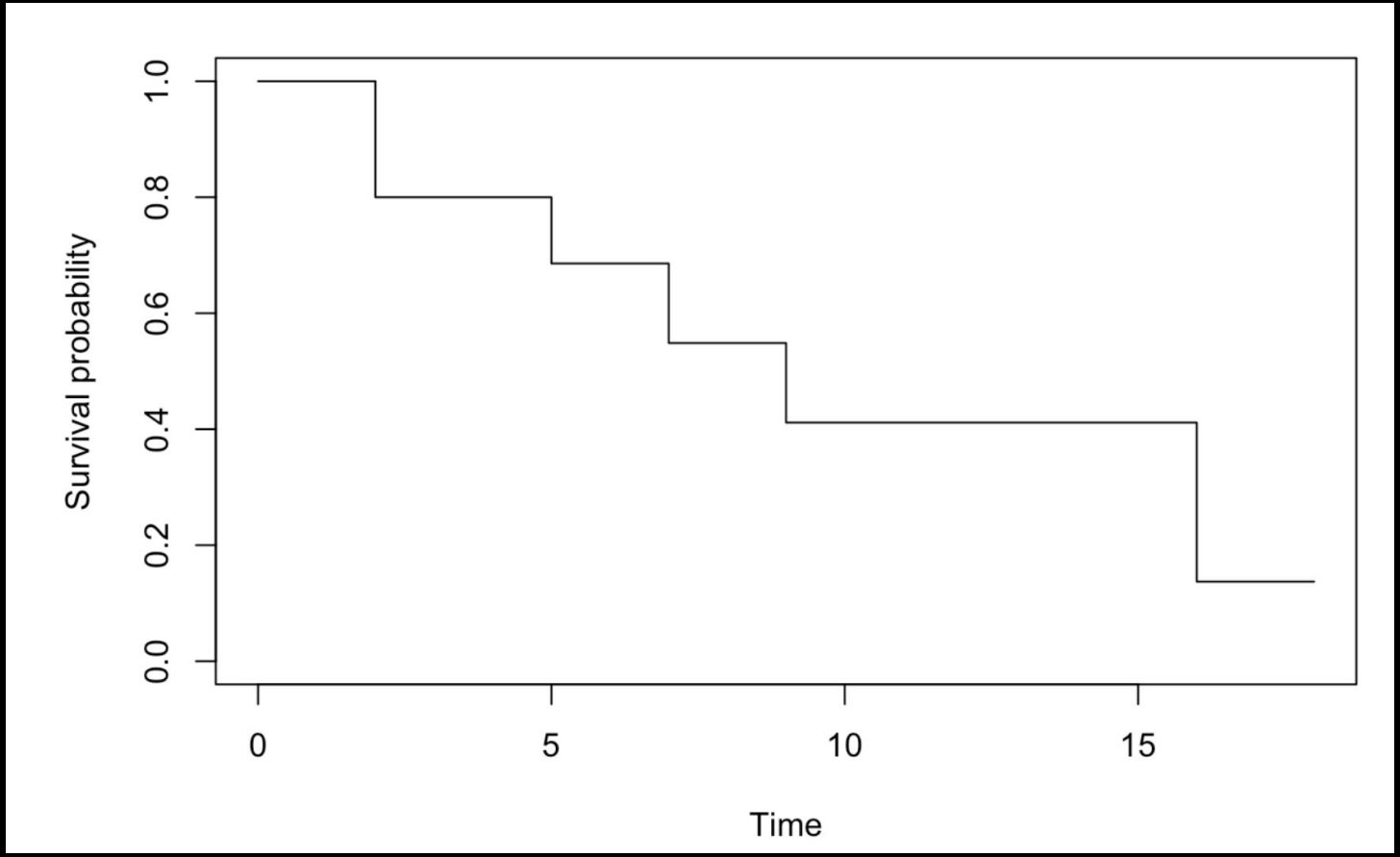
Health Outcomes

Machine Failure

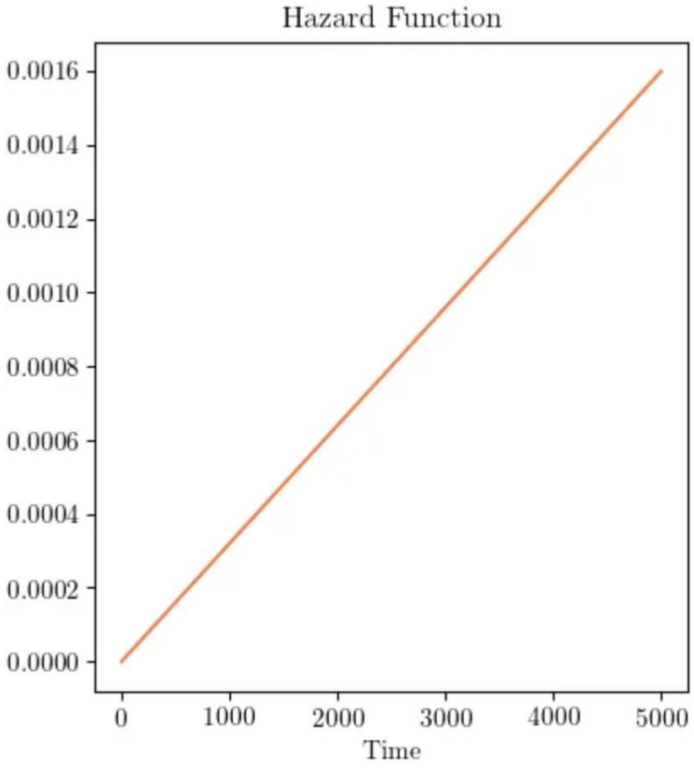
“Mission Critical” Predictions In Multi-Billion Dollar Industries!

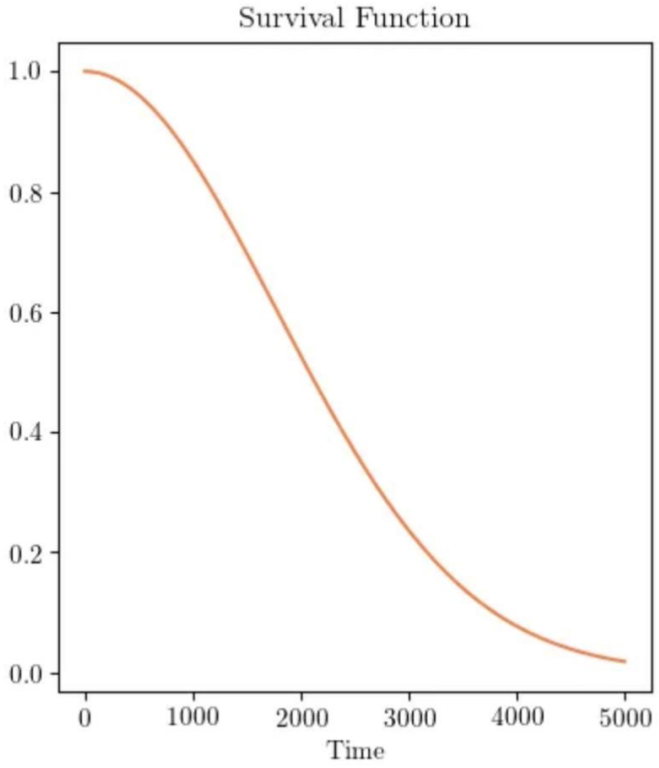
drops
Survival
period
free
observed
follow-up
Censoring
event
follow
probability
interest
time
loss
right
censoring
observation

Survival Prediction Is Probabilistic...

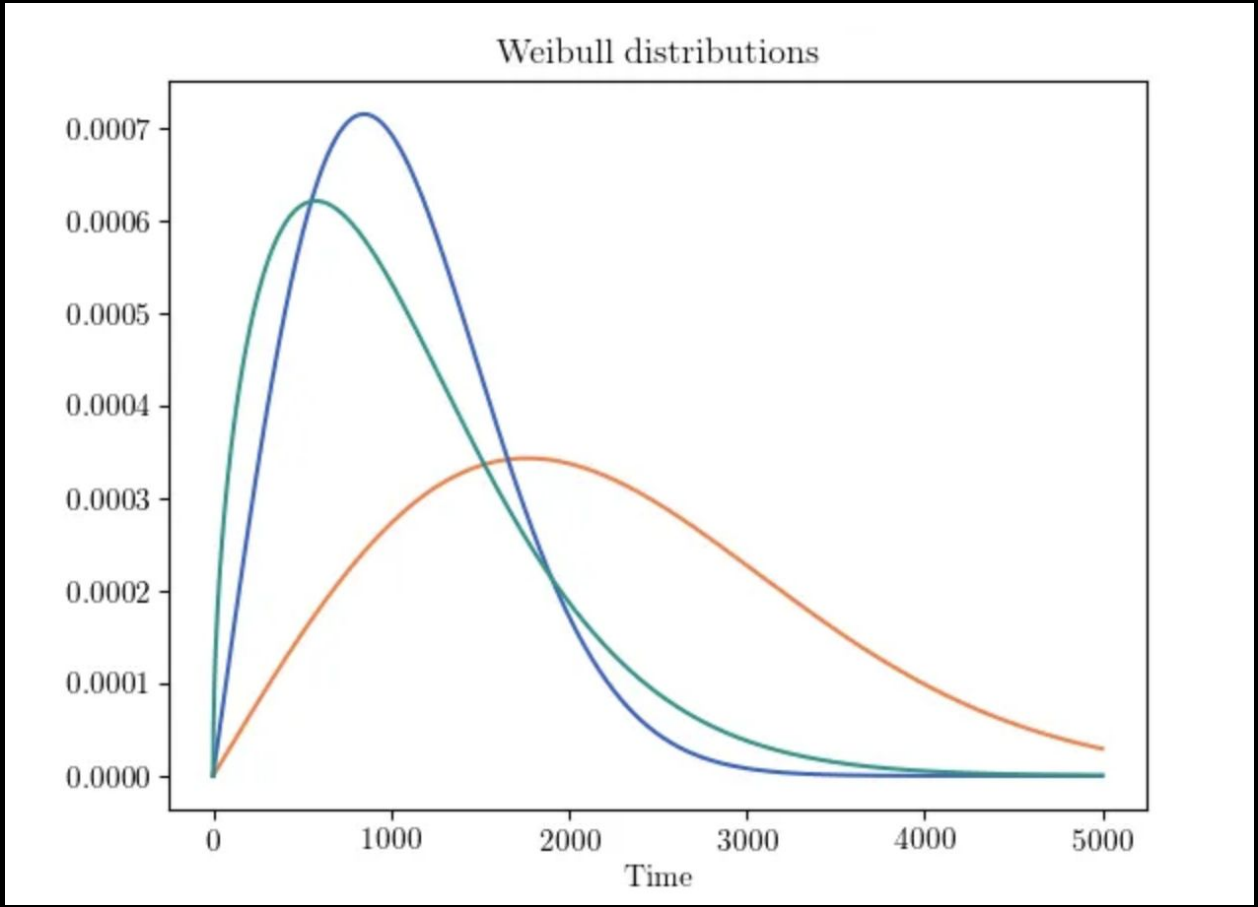


Survival Prediction Is Probabilistic...



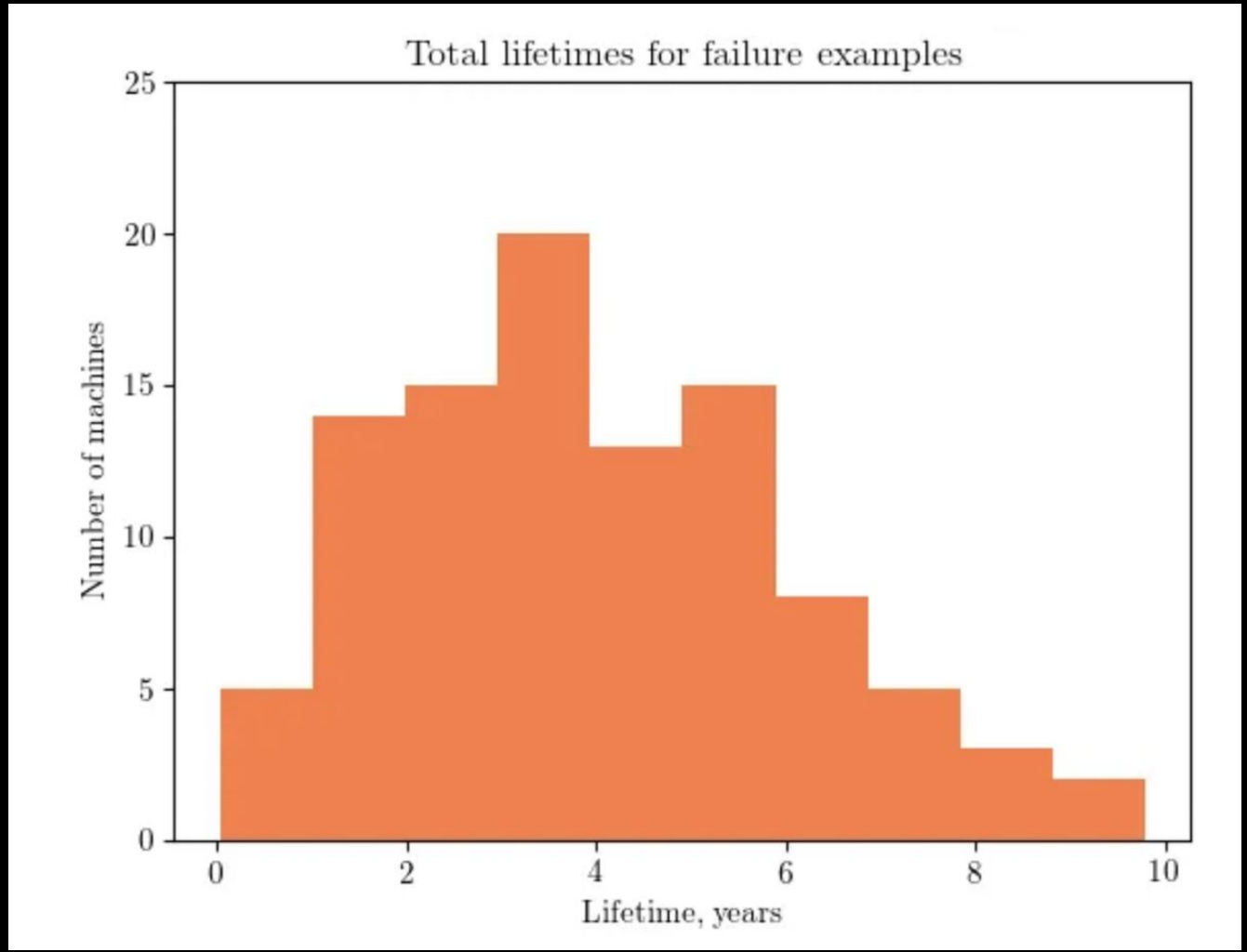


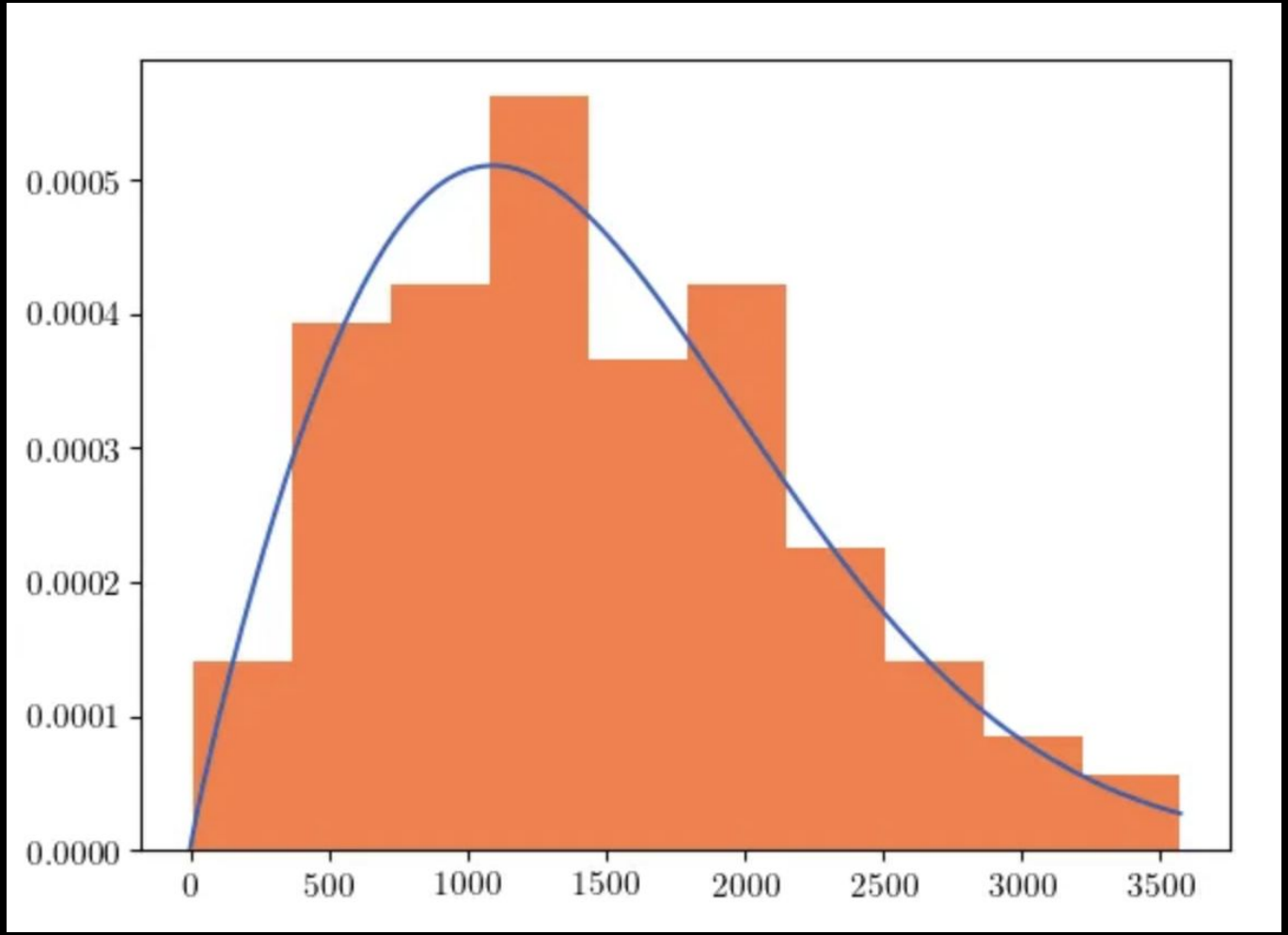
Survival Prediction Is Probabilistic...



Shape

Scale


Total lifetimes for failure examples
Number of machines
Lifetime, years
0
5
10
15
20
25
0
2
4
6
8
10


0.0005
0.0004
0.0003
0.0002
0.0001
0.0000
0
500
1000
1500
2000
2500
3000
3500

Machine Learning Approach

Beyond Curve-Fitting

- Learning from data
- Multiple underlying distributions
- Best of both worlds: distribution-driven + learning-driven

Let’s Start Coding!

Connect

WIFI:
SEEMAPLD_WORKSHOP
PW: [see note]

URL: [see note]
LOGIN: [see note]
PW: [I will provide]

- Your own Python interpreter runs on a mac-mini (“kernel”)
- Follow me and wait to “experiment”
- Issues
  - check WIFI
  - open new tab and re-login
  - new profile and login