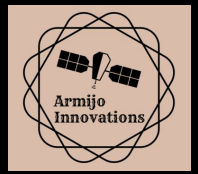
Practical ML Tutorial: Part I

—

George Williams



Tutorial Collaborators

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UT Chattanooga

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Graduate Research Assistant
UT Chattanooga

Stephen Lawrence
Graduate Research Assistant
UT Chattanooga

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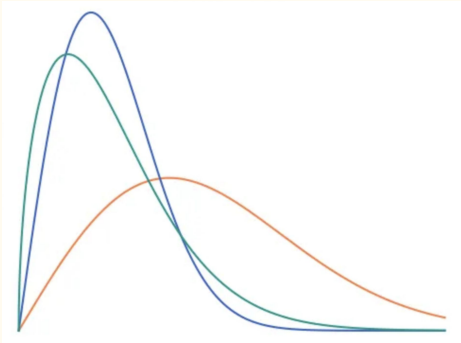
Agenda

Part I

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



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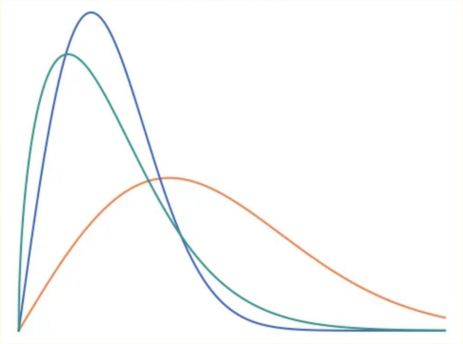

Part II

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

Hands-On

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

Hands-On

- Feel free to watch…
- Cheating is encouraged
- Is this science?
- Programming exp
- Small data/Small models

Connection information coming soon…

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Workshop Hardware

Is it space worthy? :)

Workshop Software

https://github.com/sourcesync/seemap2003

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AI Trends

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

Universal Music Group calls AI music a ‘fraud,’ wants it banned from streaming platforms.

MBW

The Hollywood Writers’ Strike May Actually Be Aiding AI’s Takeover

Gary Marcus 
@GaryMarcus

Fantastic example of the need for common sense in computer vision. Leading neural net sees two elephants, zero trees. What do you see?

Mask R-CNN trained on COCO dataset for instance segmentation. Shout-out to @ErnestSDavis for the example, @georgiagkioxari for testing. #AI #ML

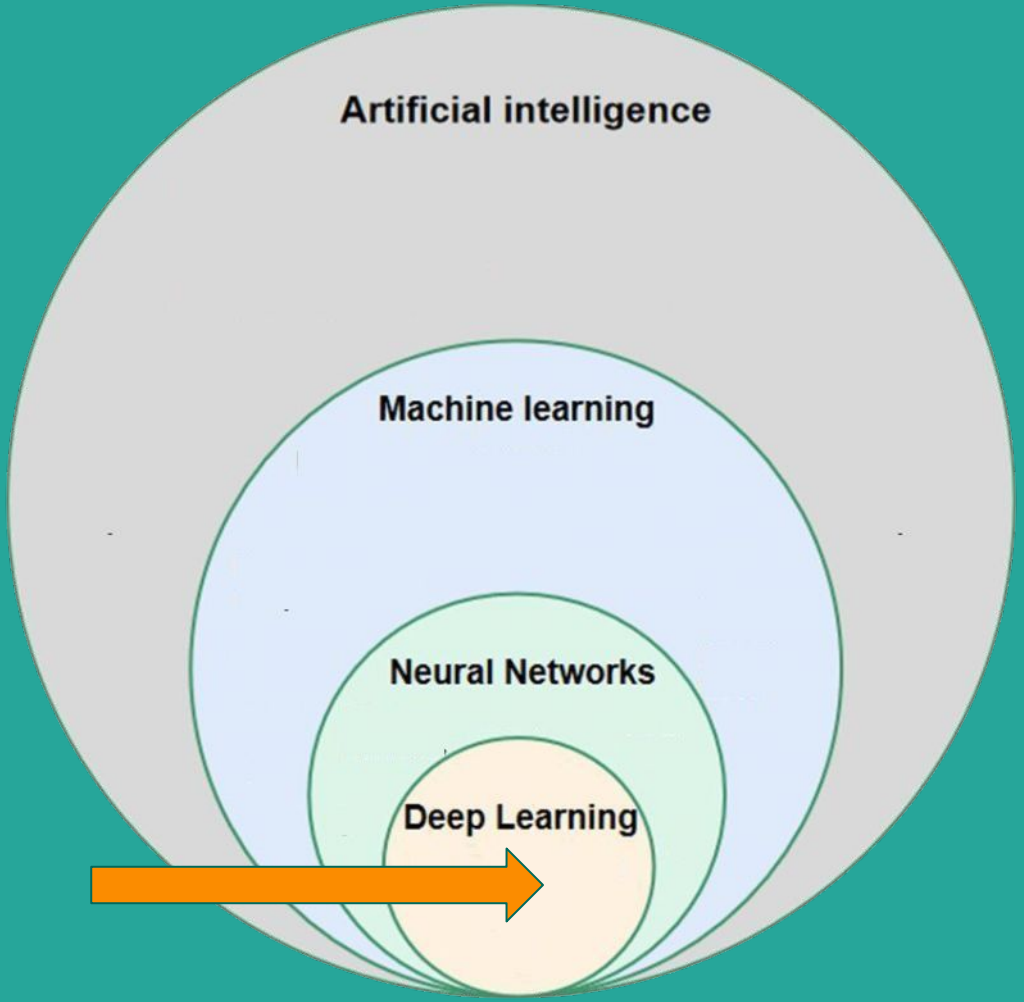
Hey ChatGPT, write a limerick for audience of radiation electronics experts.

Hey ChatGPT, write a limerick for audience of radiation electronics experts.

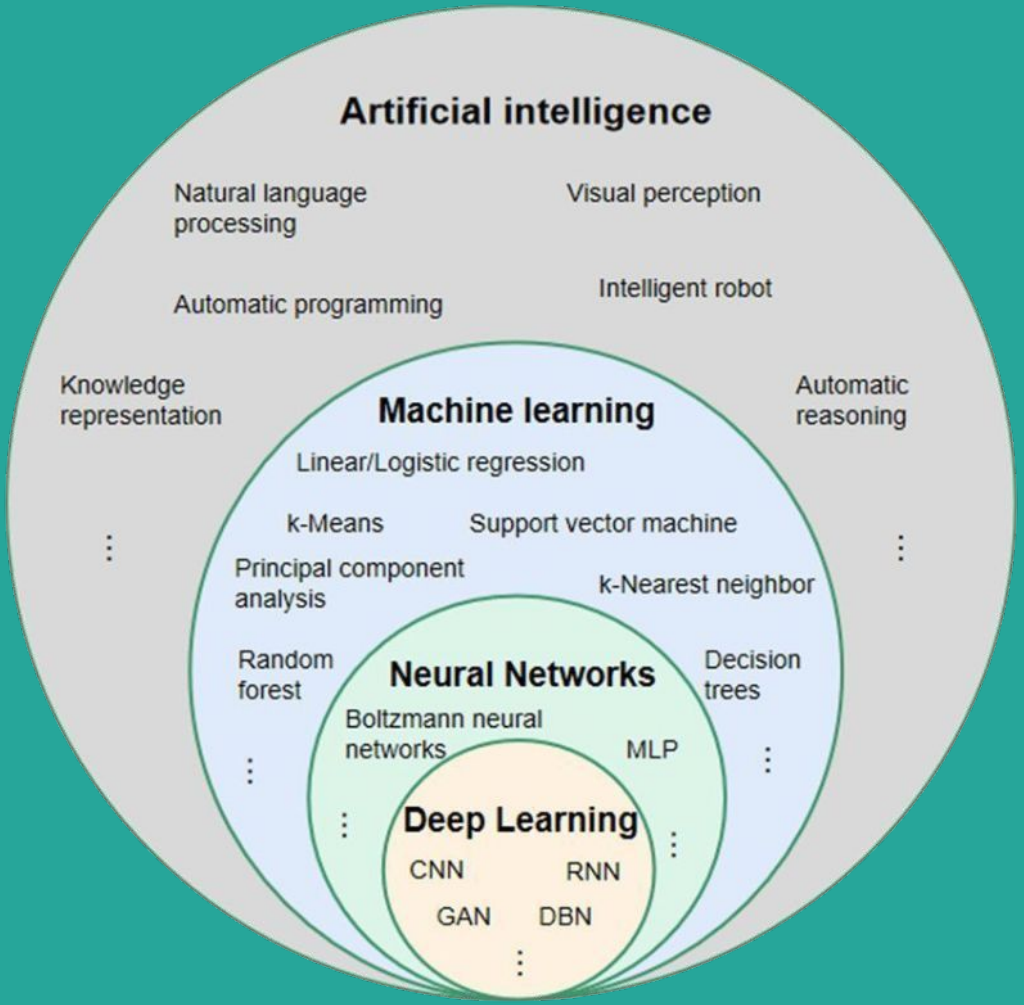
ChatGPT Says:
“There once was an electronic device,
That emitted radiation quite precise,
Its waves were quite strong,
And could last all day long,
But shielding it was always advised!”


nature
DeepMind

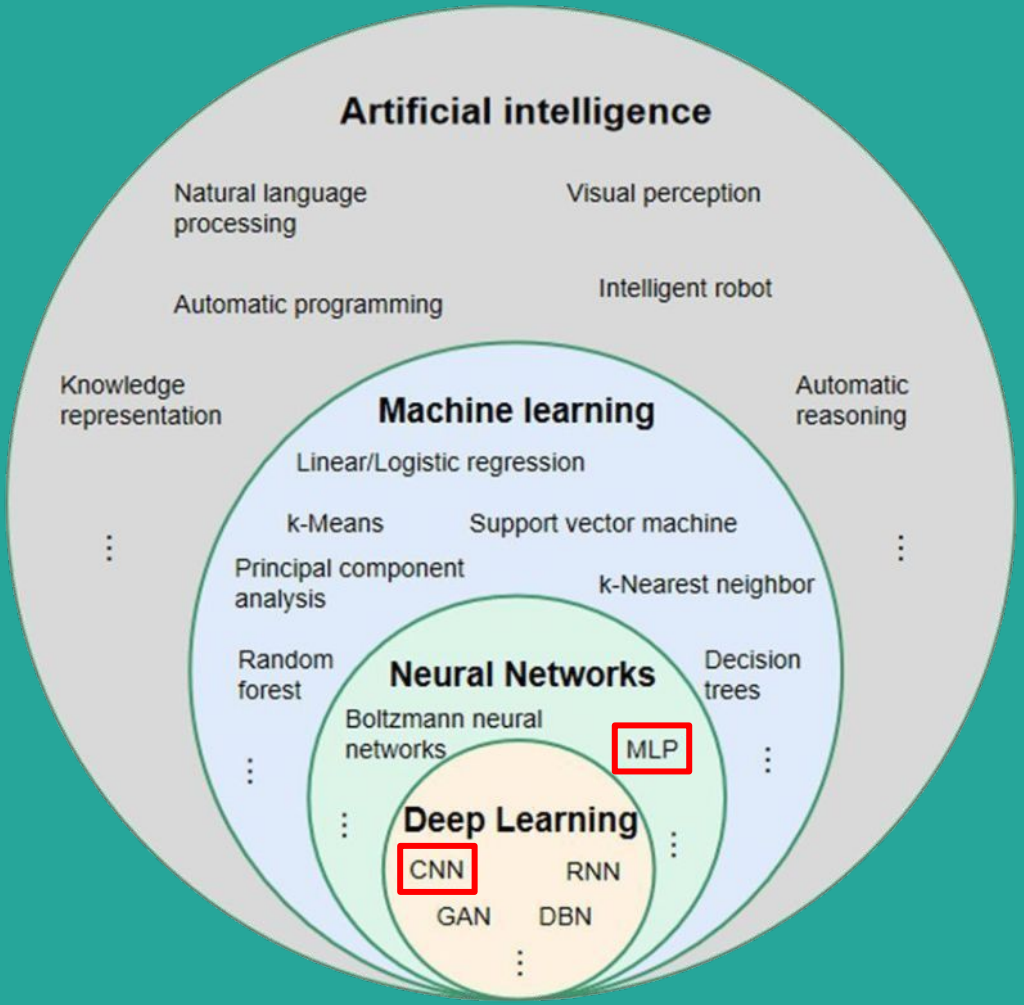
ML


Artificial intelligence
Machine learning
Neural Networks
Deep Learning

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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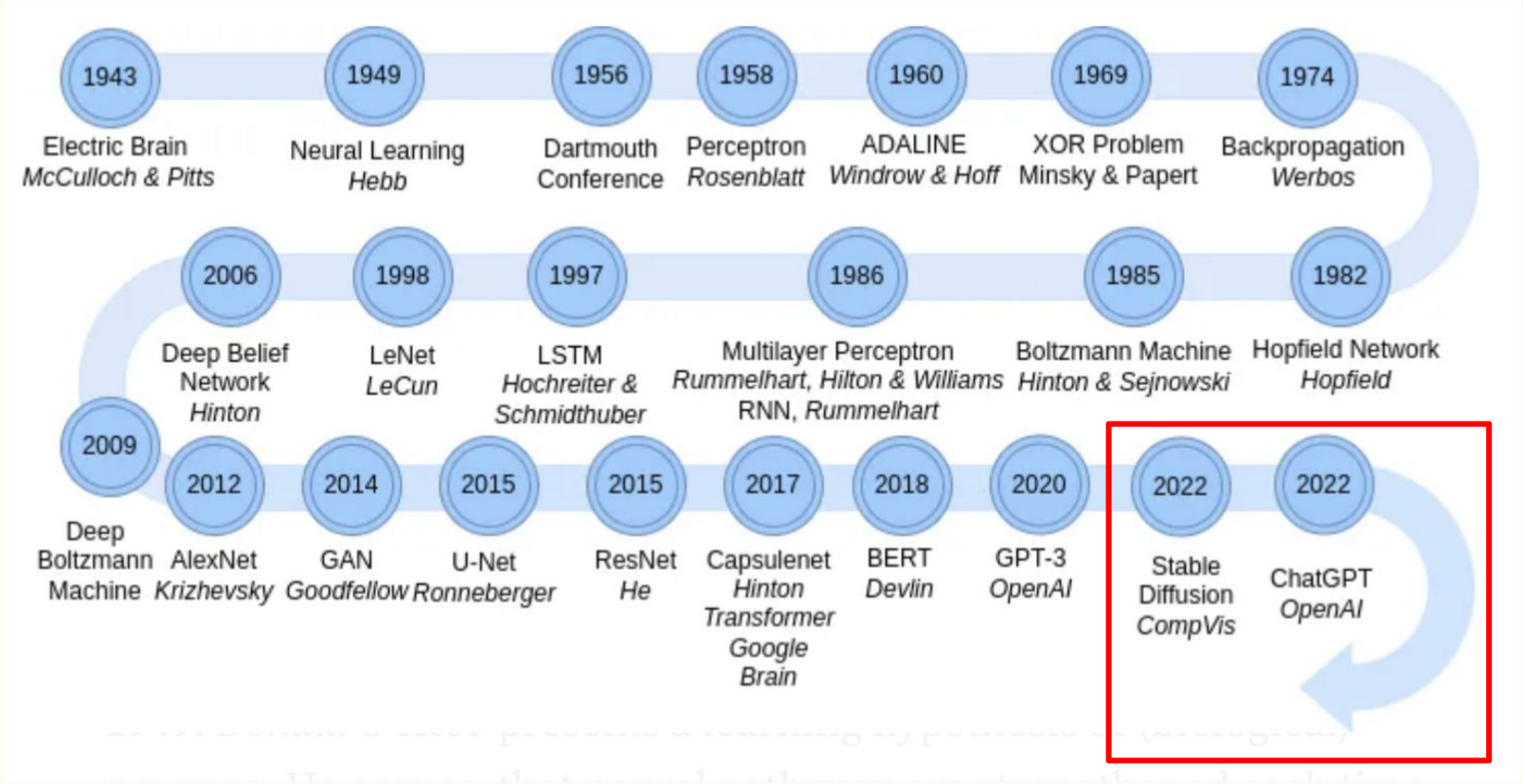
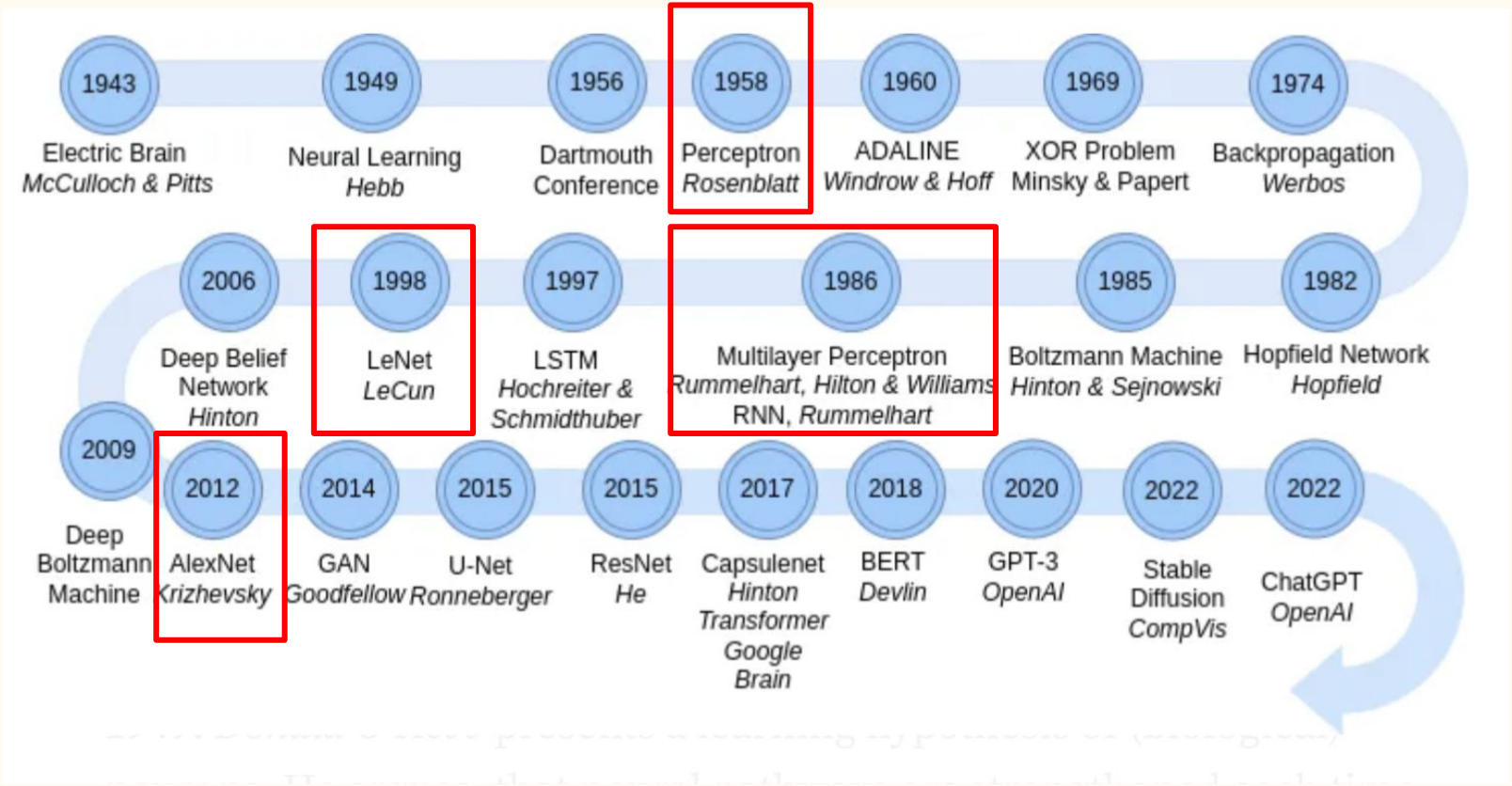
Neural Networks

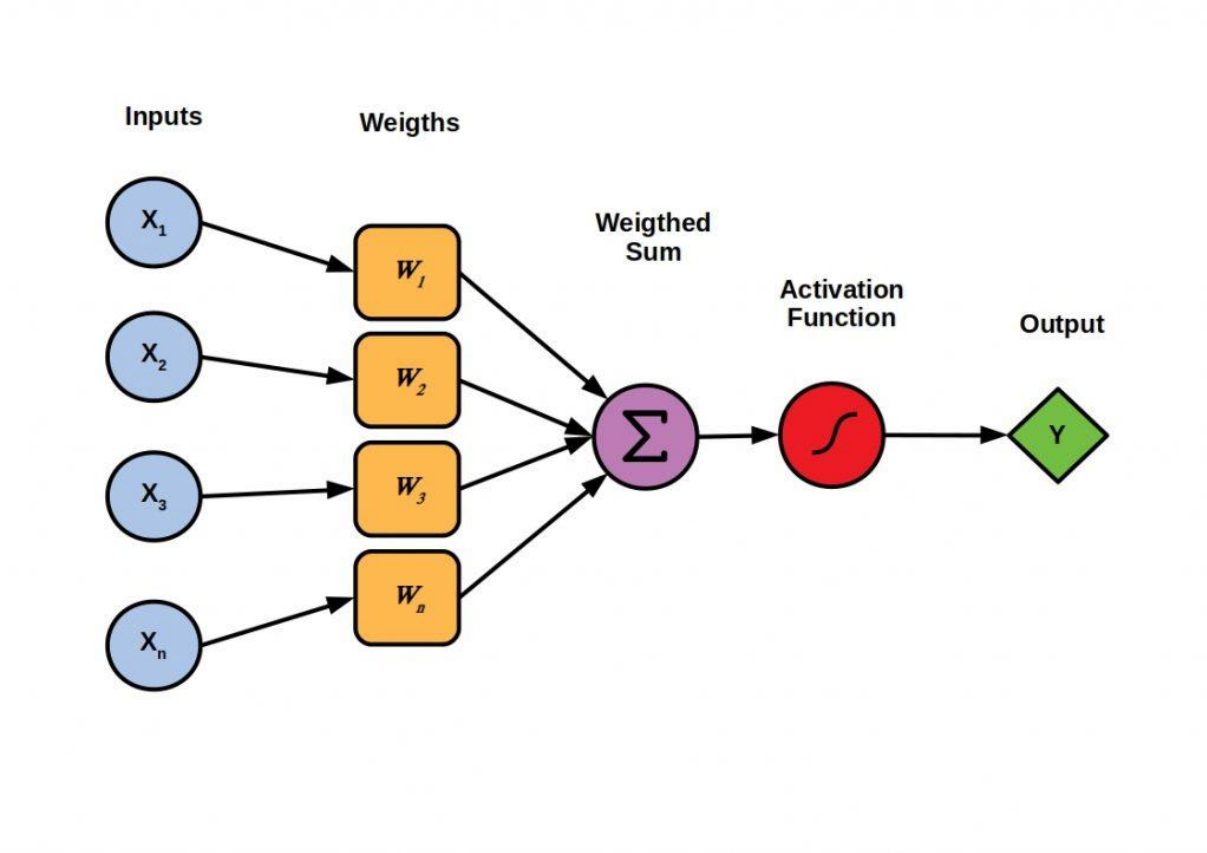


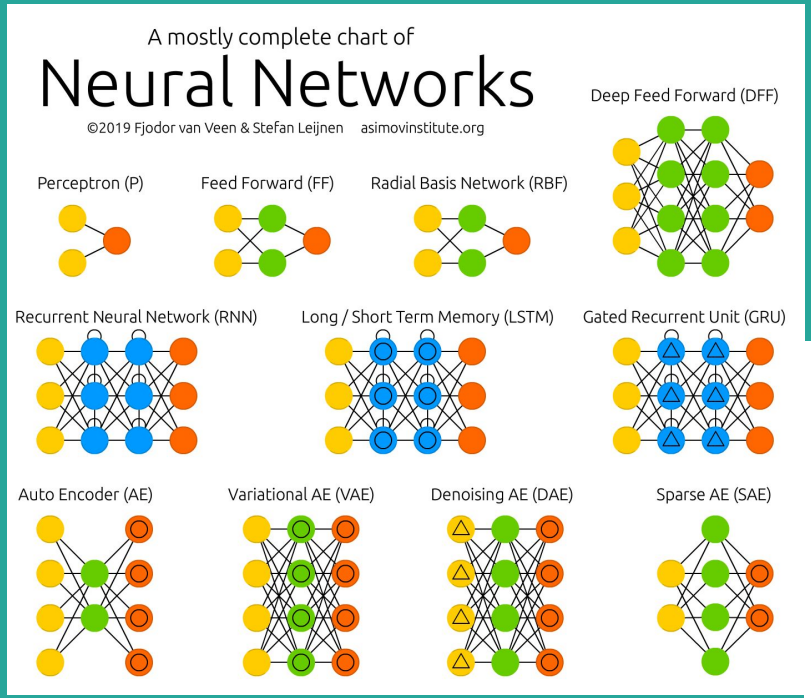
Neural Networks

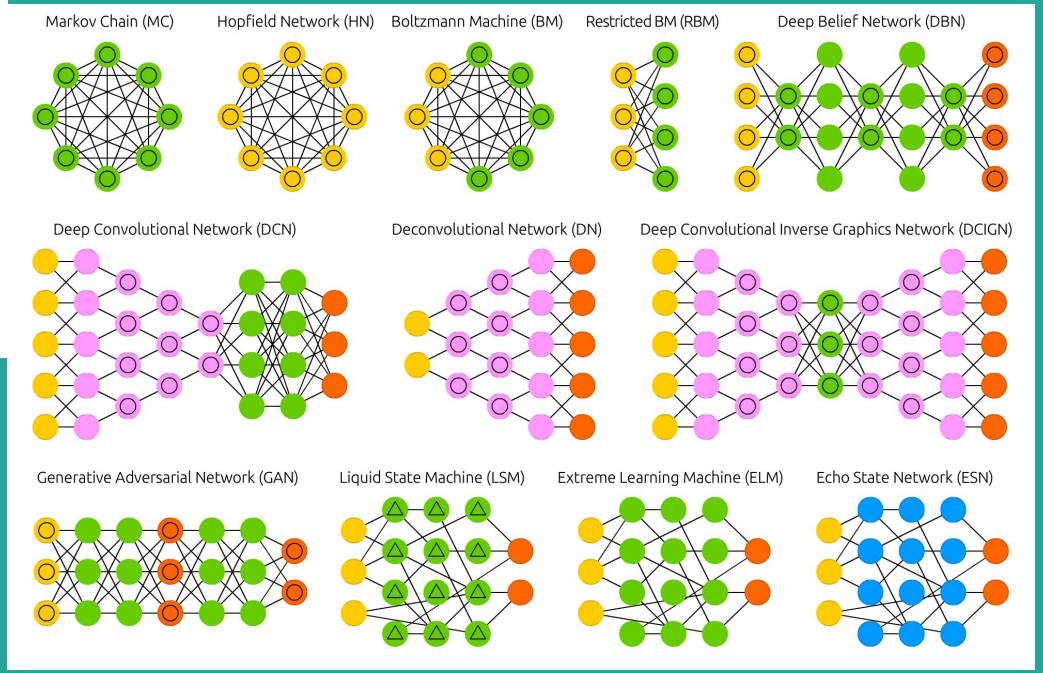


Neural Network Basics

Neural Networks Basic Unit

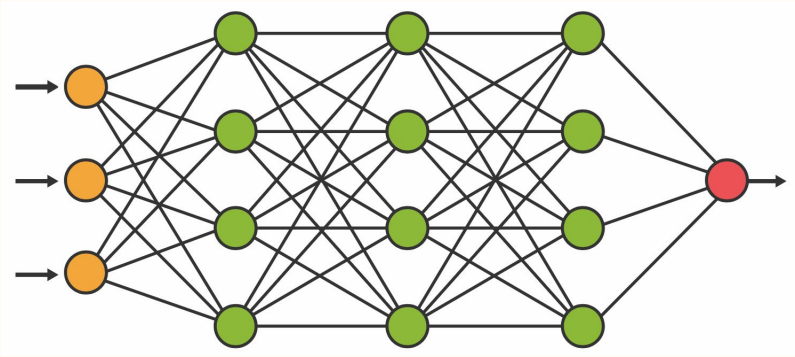






Just Google “Neural Network Zoo”...

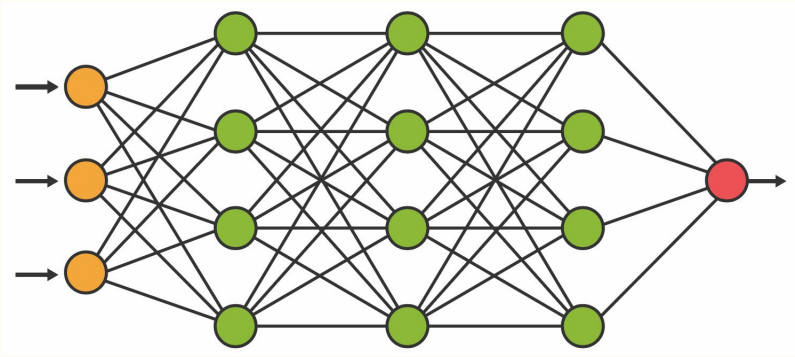
Neural Networks “In Practice”



Model

Neural Networks “In Practice”

Data

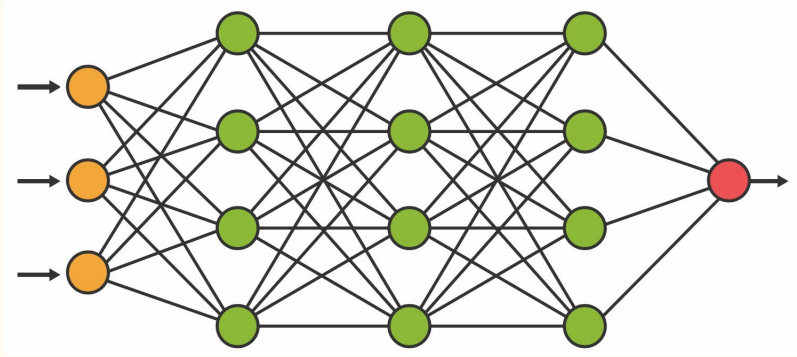


Model

Eval

Neural Networks “In Practice”

Data

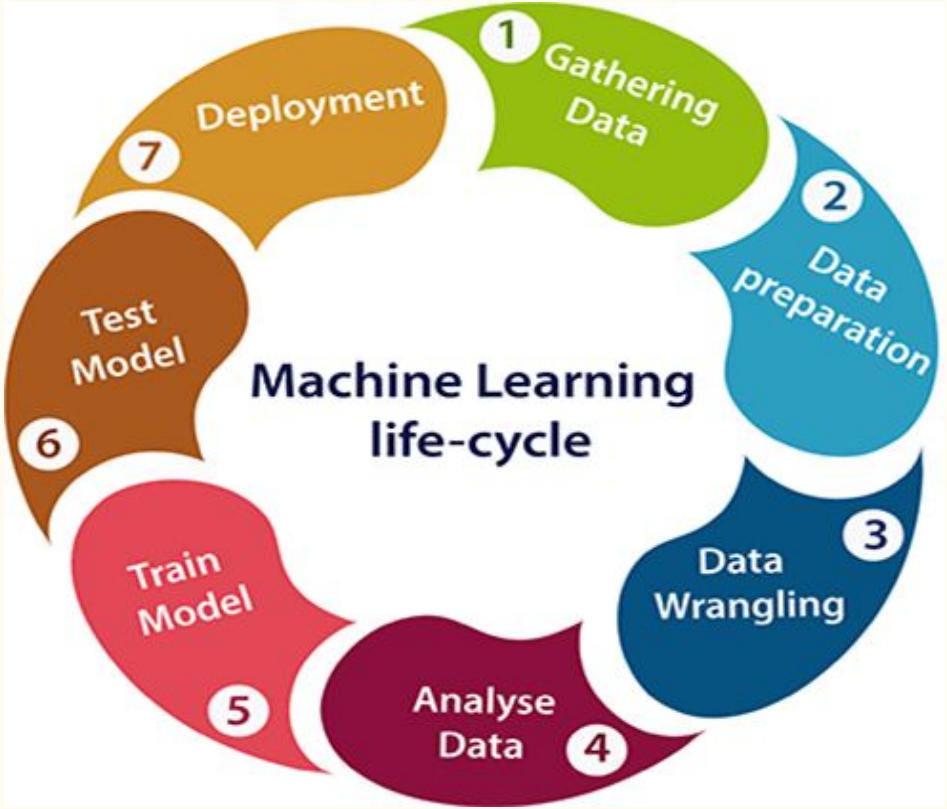


Model

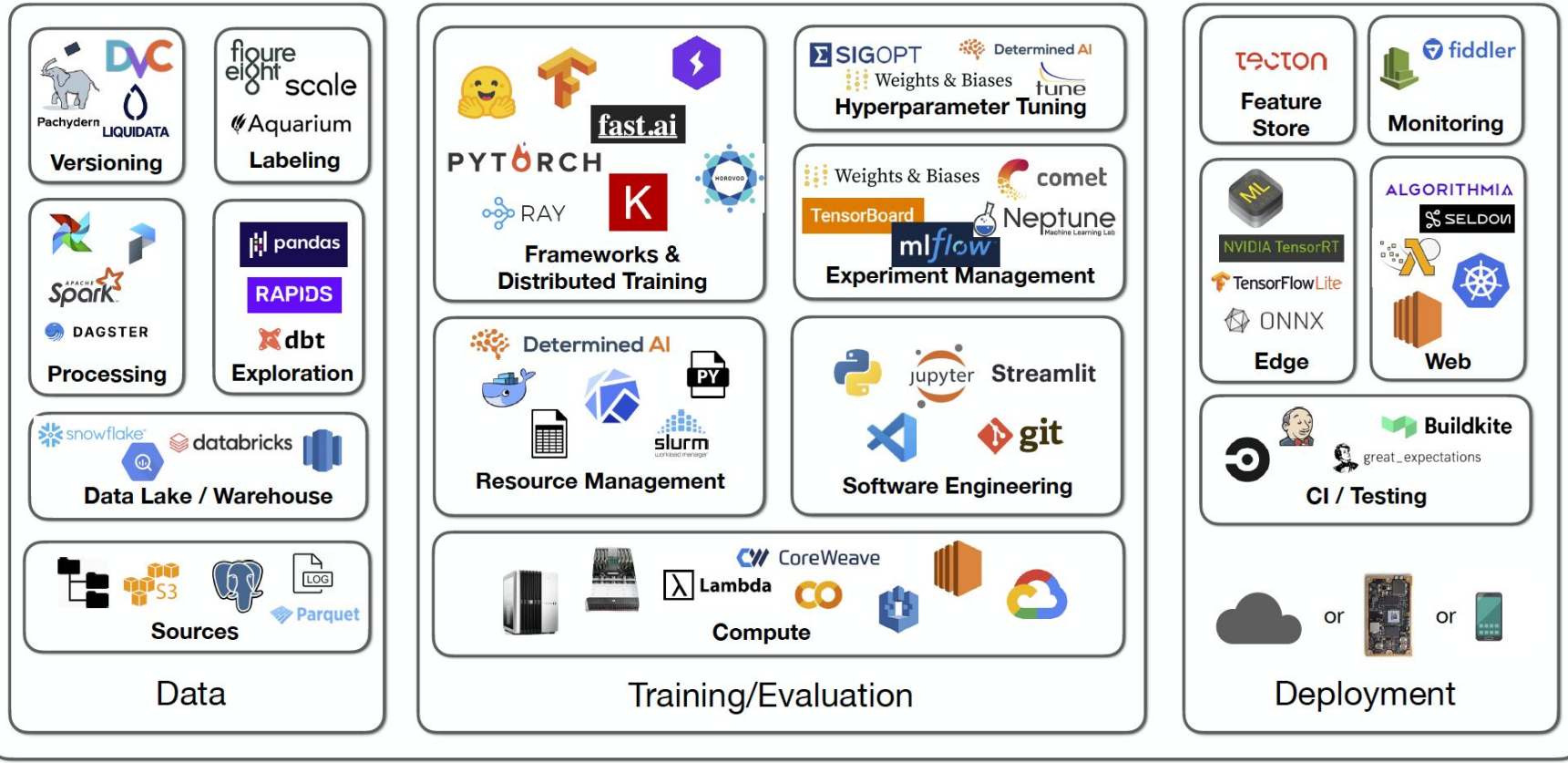
Eval

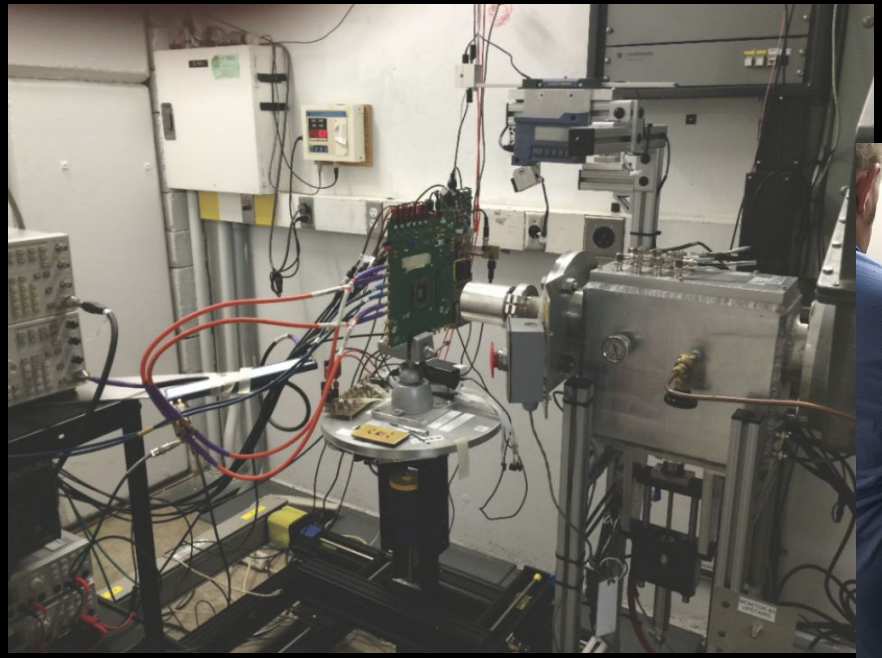
Learning Algorithm

Neural Networks “In Practice”

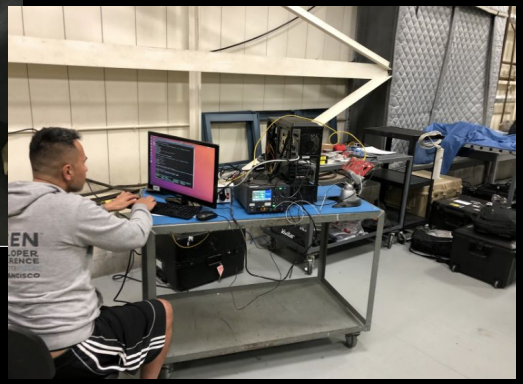


Industry ML “Ecosytem”






PATCH TO PSP COUNTING R
NO STEP



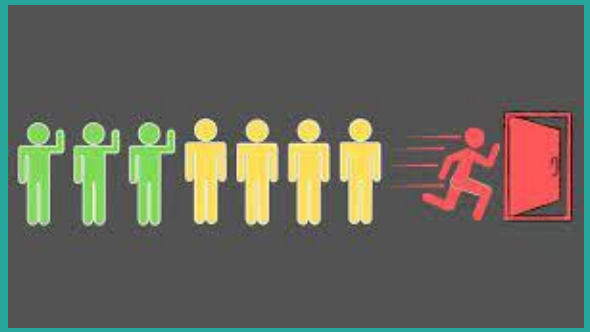
Survival Analysis

Tries To Answer The Question:

When Will It End?

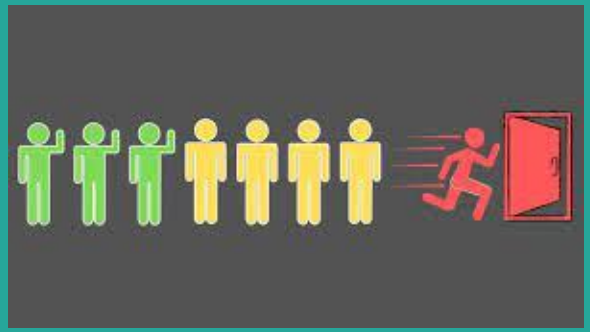
When Will It End?

When Will *It* End?



Customer Churn

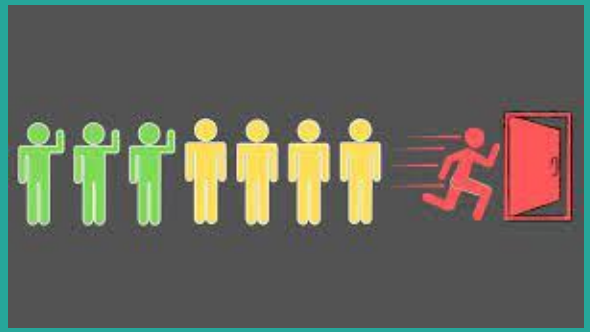
When Will *It* End?



Customer Churn

Health Outcomes

When Will *It* End?

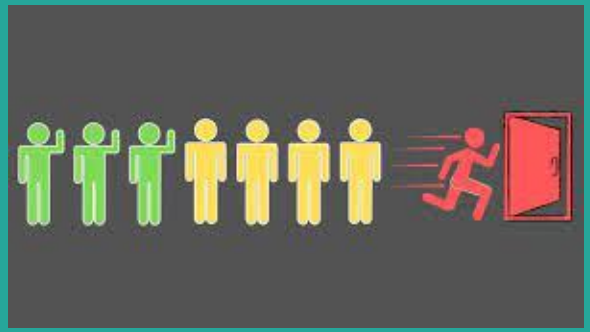


Customer Churn

Health Outcomes

Machine Failure

When Will *It* End?



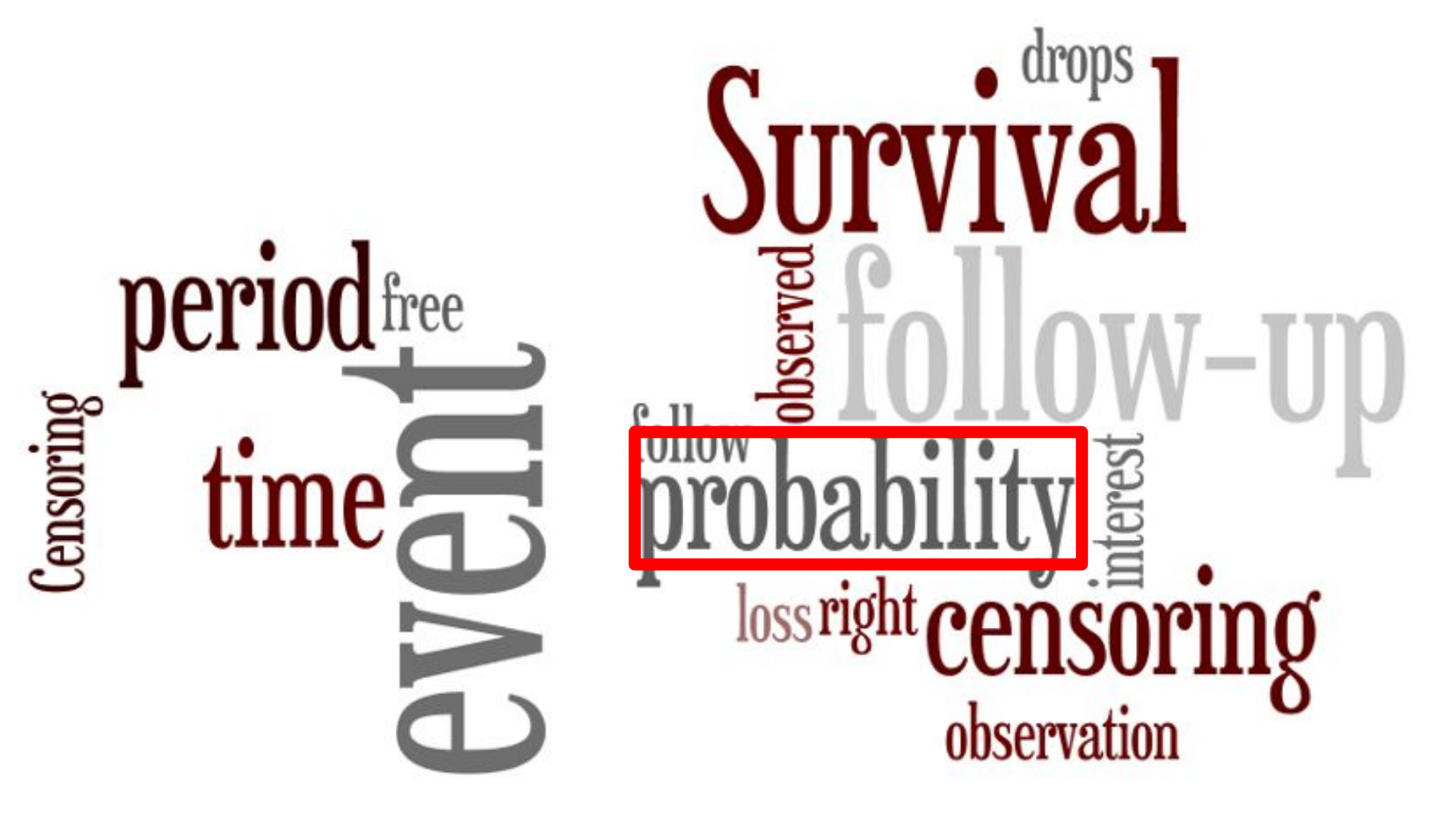
Customer Churn

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


drops
Survival
period
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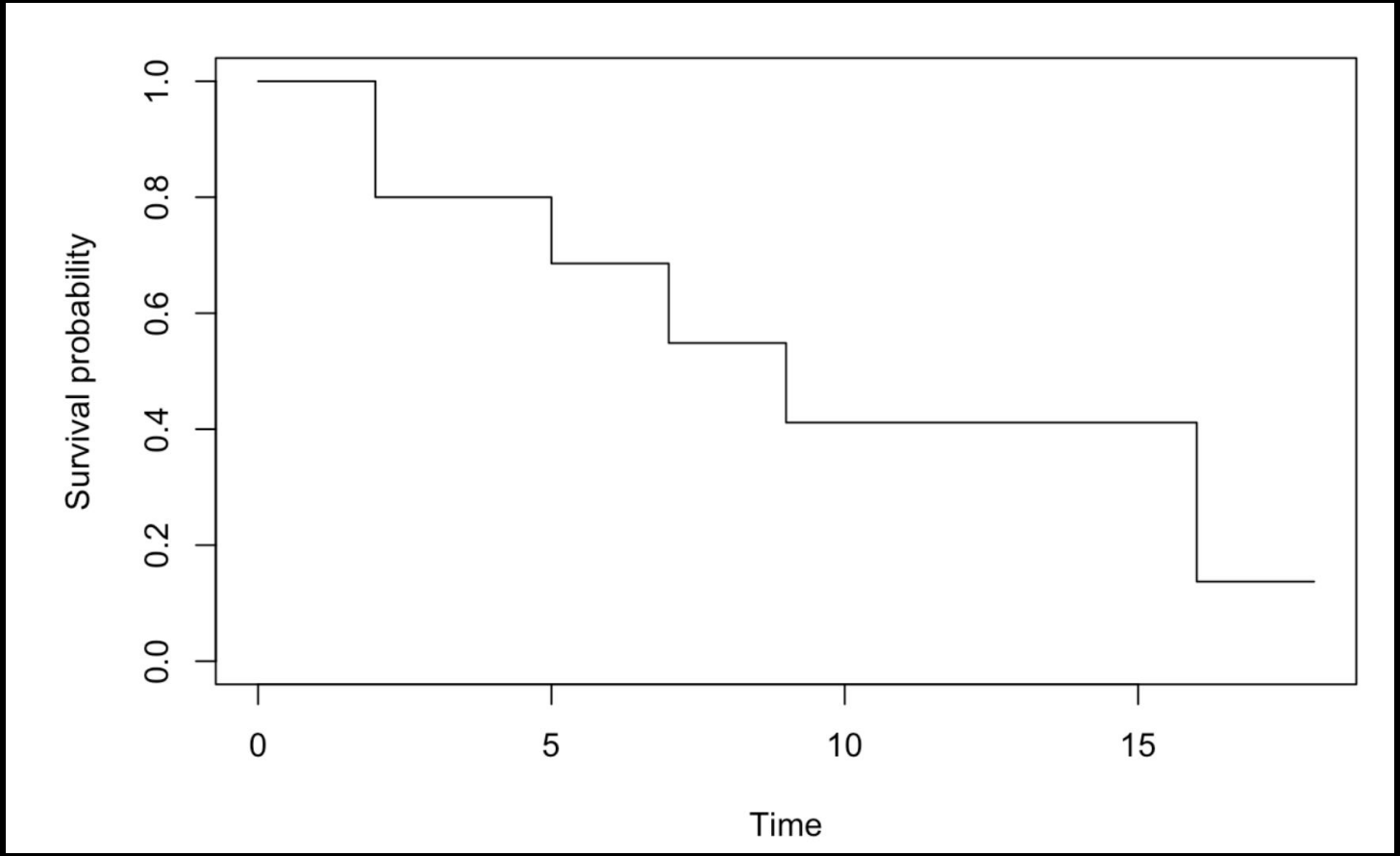
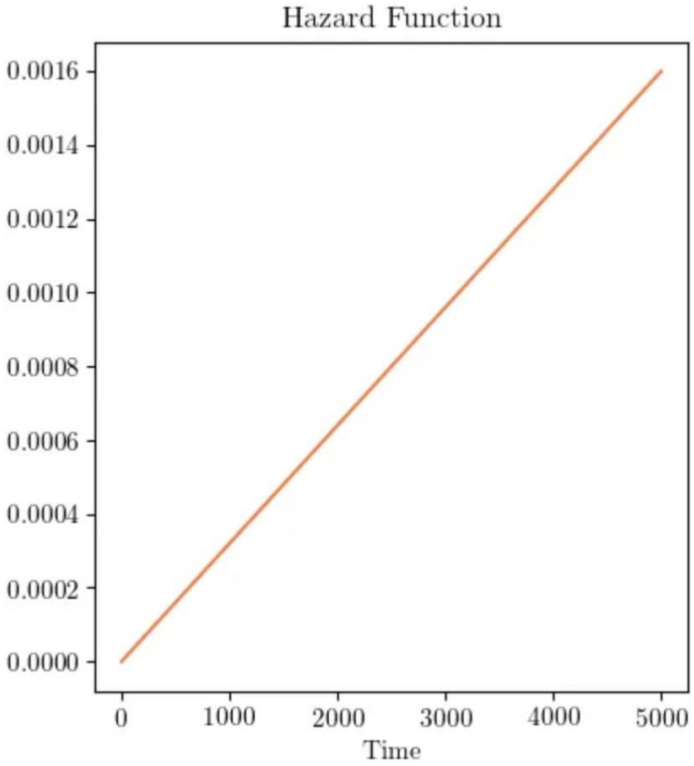
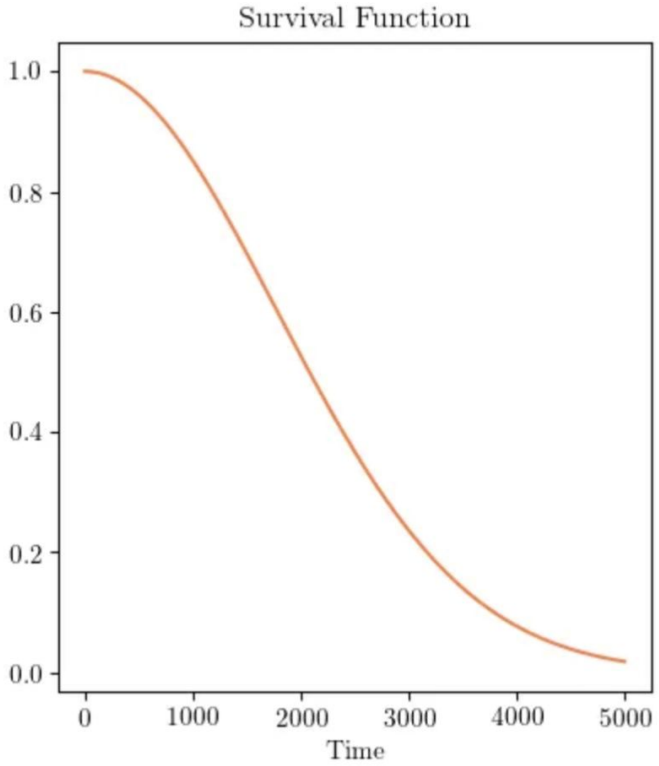
Failure/Survival Prediction Is Probabilistic...



Survival Prediction Is Probabilistic...





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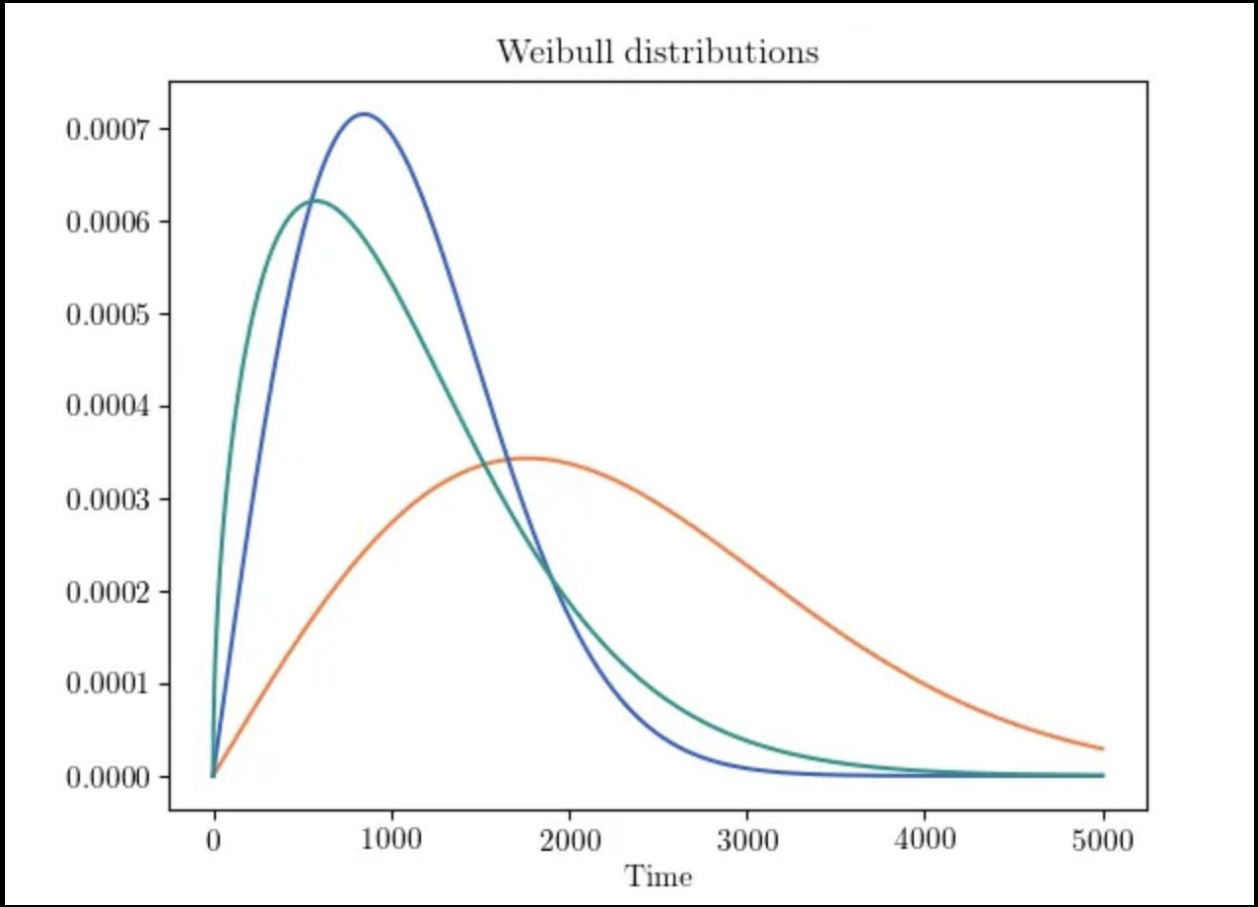
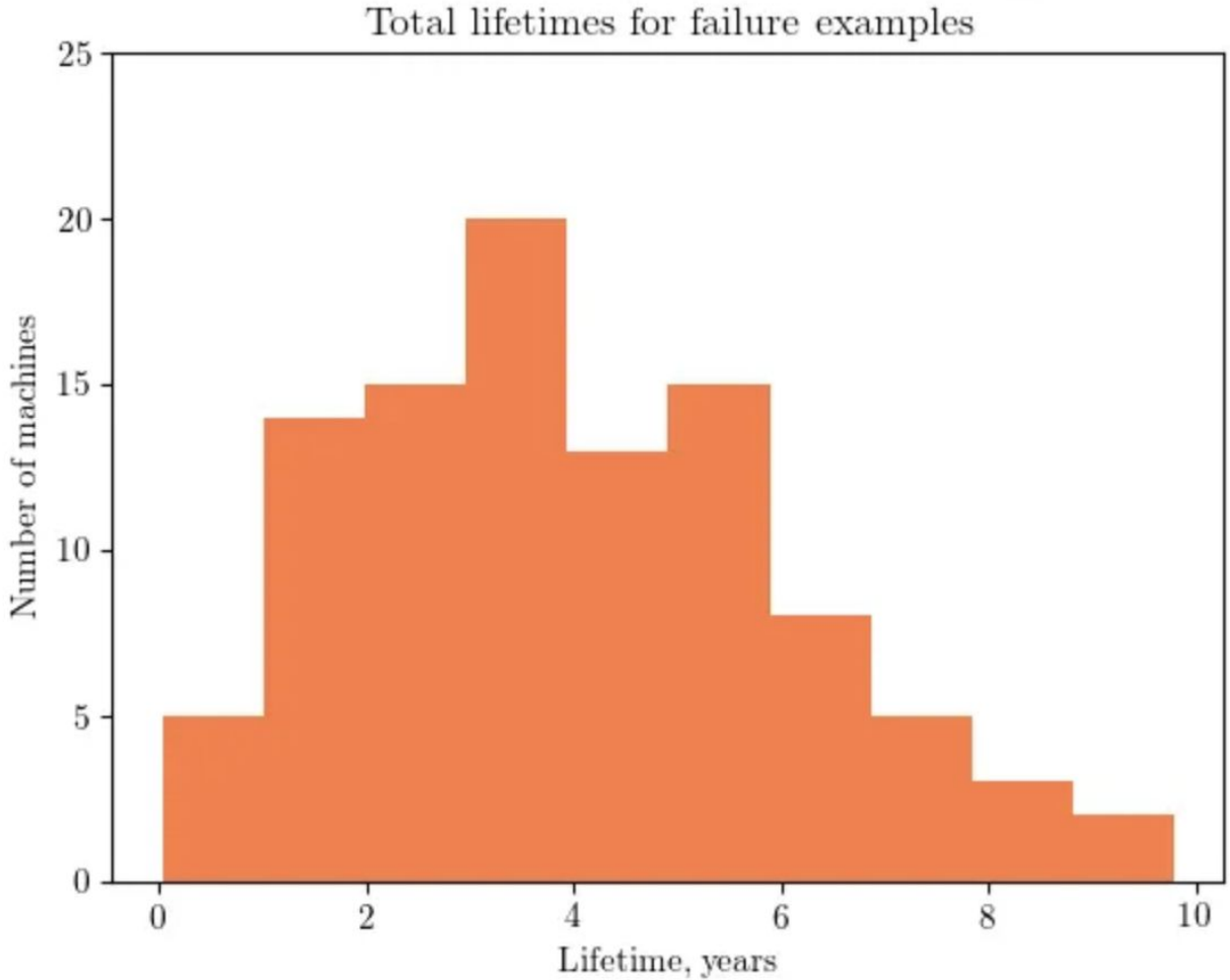
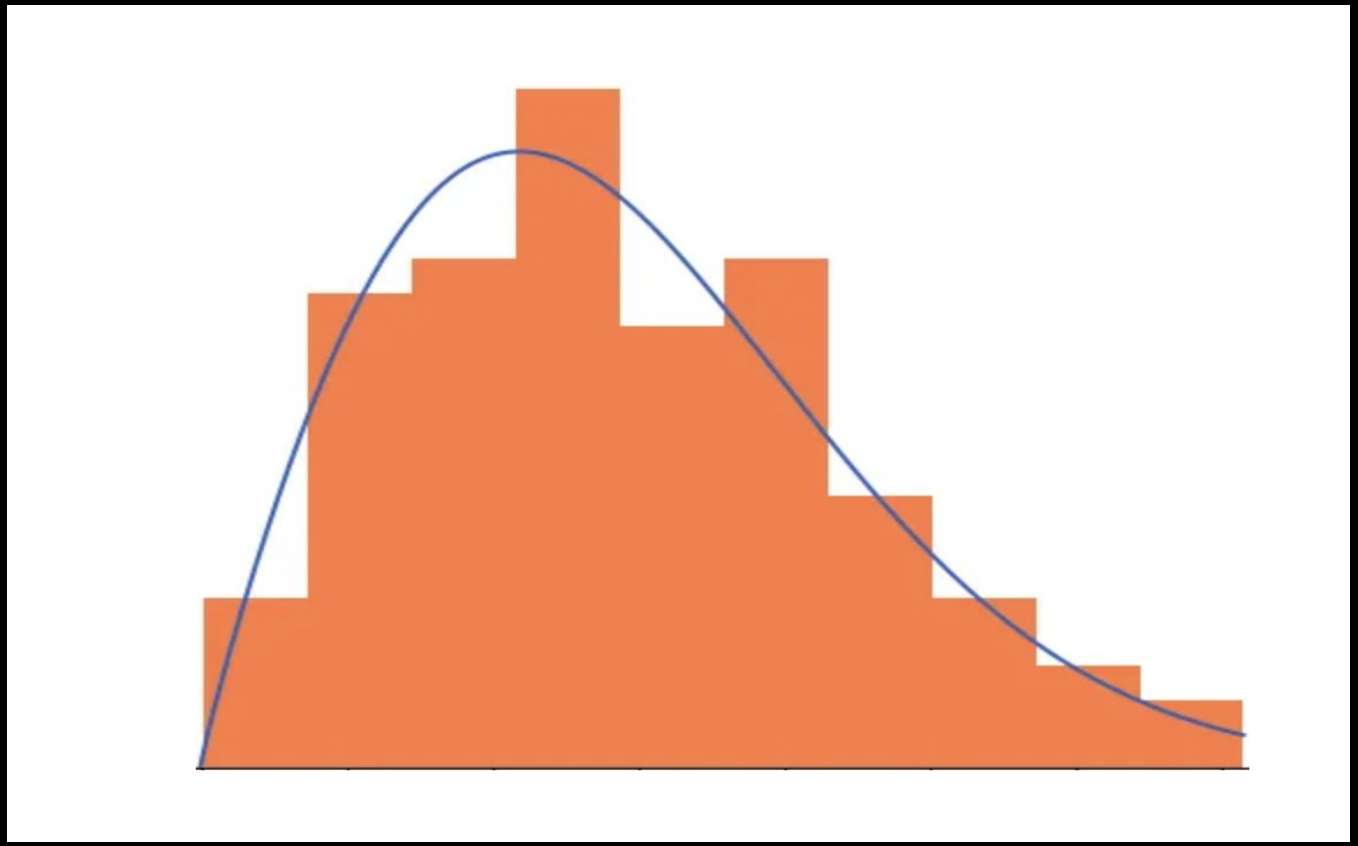


Shape

Scale


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

Easy “Fit” Right?



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: TBD
URL: TBD
LOGIN/PW: TBD

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