REPUBLIC POLYTECHNIC
DISCOVER, TRANSFORM, ACHIEVE

Introduction to Code-Free Machine Learning

Good Morning!

1) Download the presentation slides and activity worksheets at http://bit.ly/cfml_nov20

2) If your nickname used in Teams is different from the registered name, please drop a message on the channel with the registered name for attendance tracking purpose.

3) We will start at 9am sharp

Sit back and relax for now ☺

Version 1.0

Download from Github

http://bit.ly/cfml_nov20

Warm up!

Step 1: Go to the following url

http://bit.ly/cfml_warmup

Step 2: facilitator will walk you through the following 2 questions

1) **Write down what you know about code-free and machine learning**

2) **What do you hope to gain from this workshop.**

3 mins

Programme

Section 1:	What is Machine Learning Machine Learning Workflow
Section 2:	Activity 1 – First Machine Learning with Azure
Section 3:	Activity 2 - Deploying your experiment as a Web Service & Make Prediction using Excel
	Lunch Break
Section 4:	Transfer Learning Computer Vision: Activity 3 – Car Damage Assessment Classification
Section 5:	Natural Language Processing Activity 4 – Book Genre Classifier
Section 6:	Linking them together
Section 7:	Debrief

Introduction of trainer

Name
Seow Khee Wei
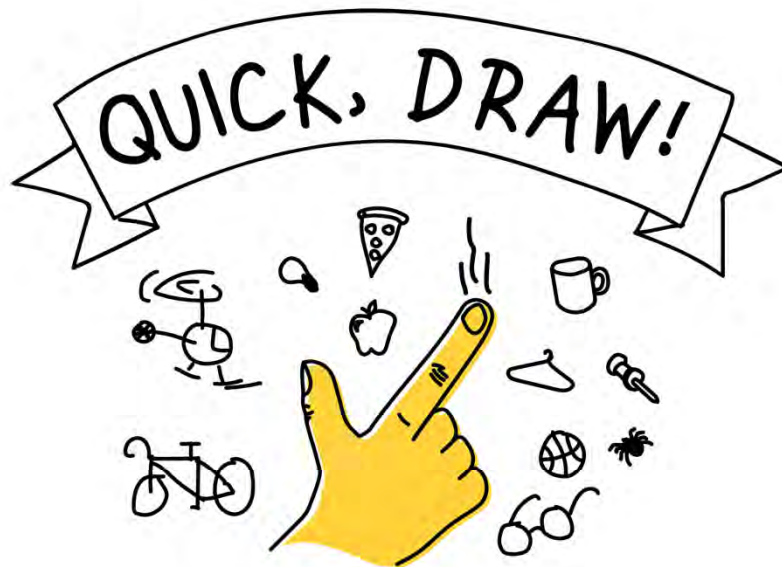
Telegram
@kwseow

Email
seow_khee_wei@rp.edu.sg

Projects

Scene Understanding

Diabetic Foot At Risk Reconstruction

Language model for Medical Certificates

Quickdraw Game

https://quickdraw.withgoogle.com

Optional Activity

5 mins

How does ML work in QuickDraw?

- https://quickdraw.withgoogle.com/data/apple
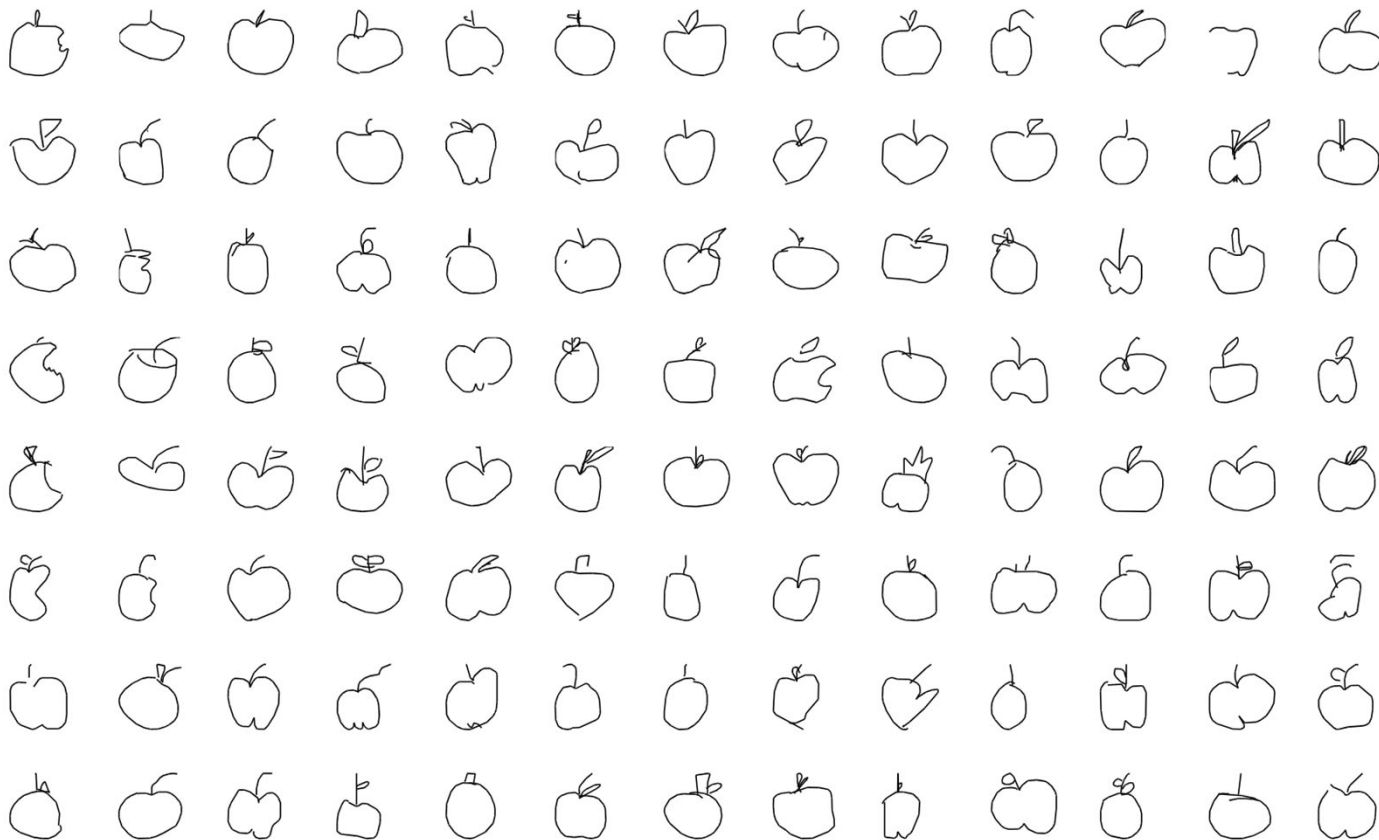
Bias Bias Bias

When It Comes to Gorillas, Google Photos Remains Blind

Google promised a fix after its photo-categorization software labeled black people as gorillas in 2015. More than two years later, it hasn't found one.
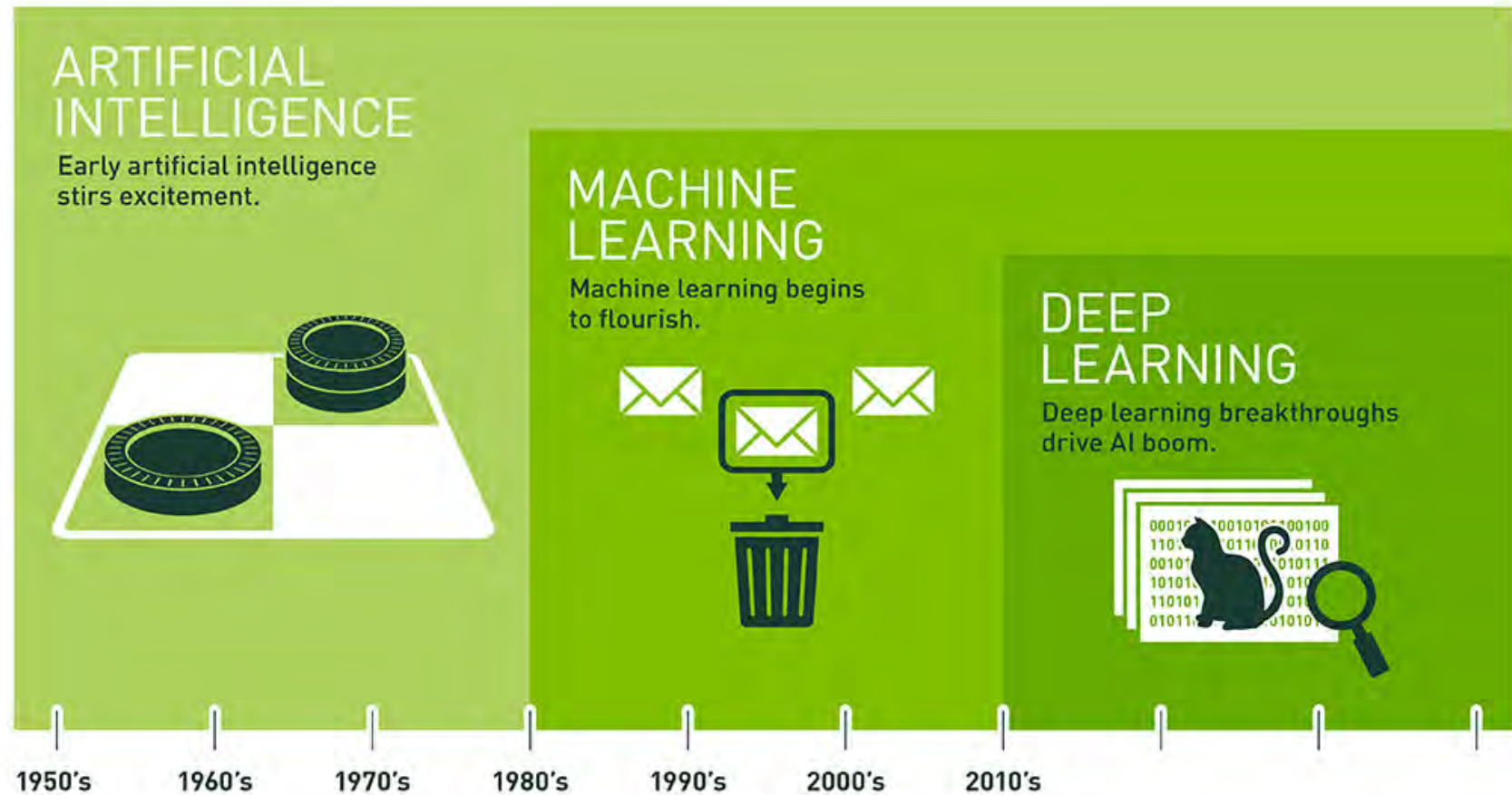

In WIRED's tests, Google Photos did identify some primates, but no gorillas like this one were to be found. RICK MADONIK/TORONTO STAR/GETTY IMAGES

https://www.wired.com/story/when-it-comes-to-gorillas-google-photos-remains-blind/

AI Time line

ARTIFICIAL INTELLIGENCE
Early artificial intelligence stirs excitement.

MACHINE LEARNING
Machine learning begins to flourish.

DEEP LEARNING
Deep learning breakthroughs drive AI boom.

1950's   1960's   1970's   1980's   1990's   2000's   2010's

Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.
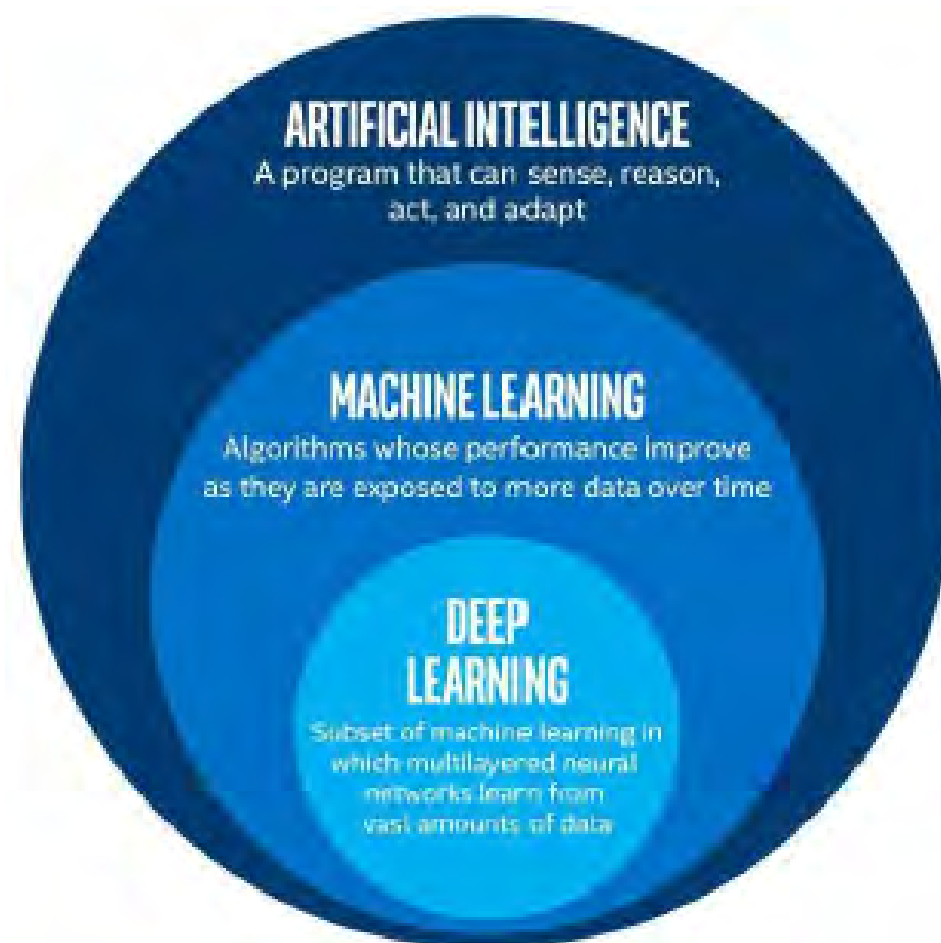
Source: Nvidia

Machine Learning

- These programs learn from repeatedly seeing data, rather than being explicitly programmed by humans

Supervised Learning

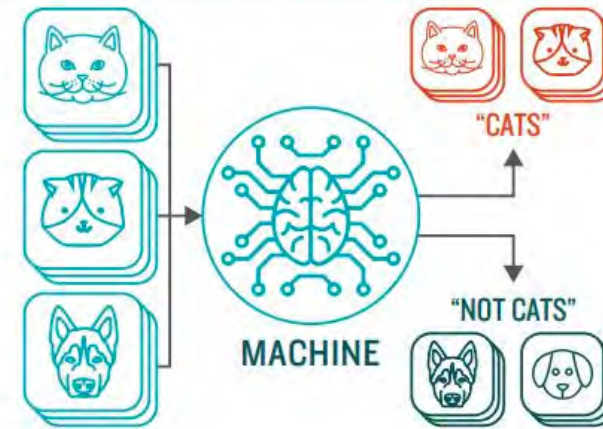Data points have **known** outcome

Unsupervised Learning

Data points have **unknown** outcome

How **Unsupervised** Machine Learning Works

STEP 1 Provide the machine learning algorithm uncategorized, unlabeled input data to see what patterns it finds
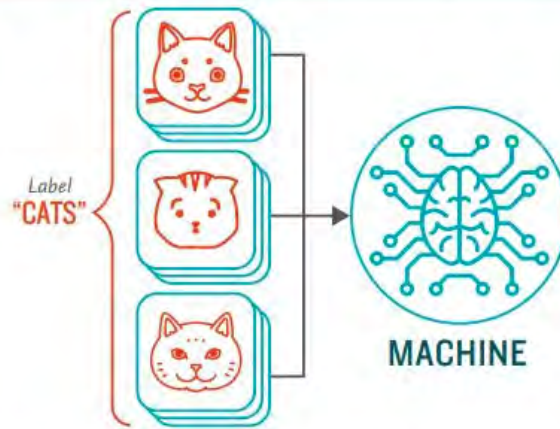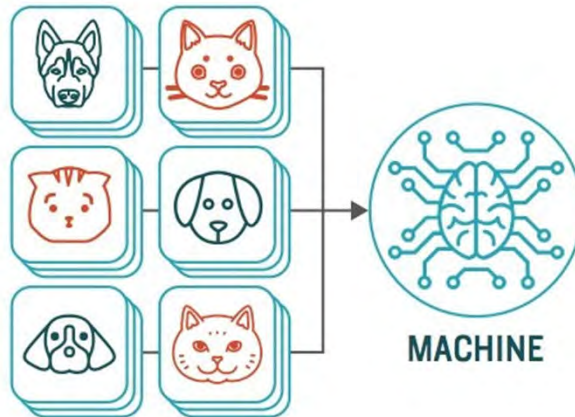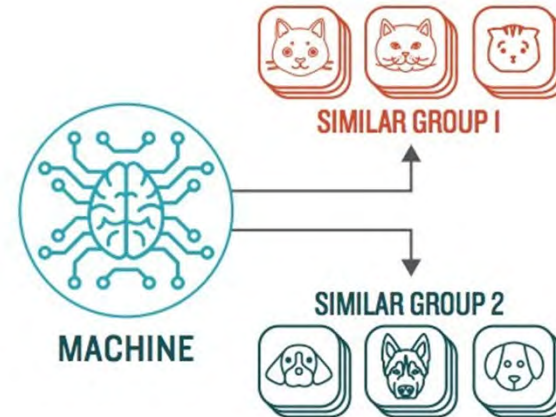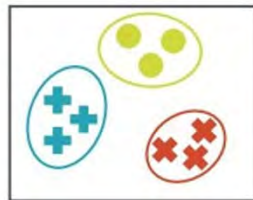
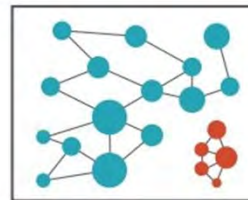**STEP 2** Observe and learn from the patterns the machine identifies

MACHINE

SIMILAR GROUP 1

MACHINE

SIMILAR GROUP 2

TYPES OF PROBLEMS TO WHICH IT'S SUITED

CLUSTERING

Identifying similarities in groups

For Example: Are there patterns in the data to indicate certain patients will respond better to this treatment than others?

ANOMALY DETECTION

Identifying abnormalities in data

For Example: Is a hacker intruding in our network?

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Machine Learning

- Applications in our daily lives

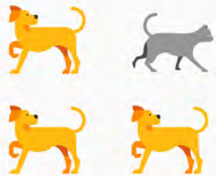|		
Spam Filtering	Web Search	Postal Mail Routing
Fraud Detection	Movie Recommendations	Vehicle Driver Assistance
Web Advertisements	Social Networks	Speech Recognition

5 fundamental questions

**Is this weird?
(Anomaly detection)**

**Is this A or B?
(Classification)
(discrete values)**

**How many?
How Much?
(Regression)
(Continuous)**

**How is this organized?
(Clustering)**

**What should I do?
(Reinforce Learning)**

Is this pressure gauge reading normal?
Is this message from the internet typical?

Will this tire fail in the next 1,000 miles: Yes or no?
Which brings in more customers: a $5 coupon or a 25% discount?

Monday · Tuesday · 72°

What will the temperature be next Tuesday?
What will my fourth quarter sales be?

Which viewers like the same types of movies?
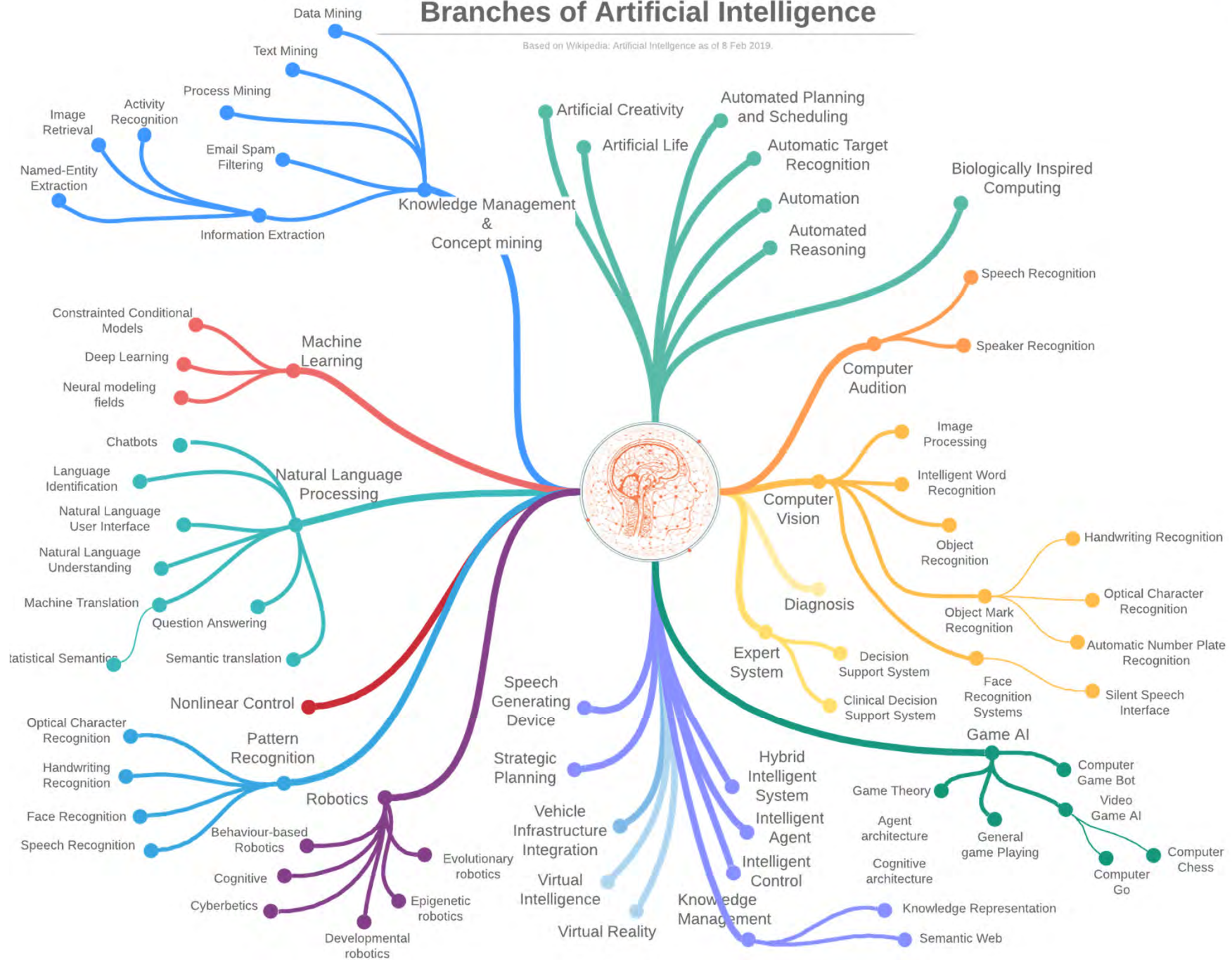Which printer models fail the same way?

If I'm a self-driving car: At a yellow light, brake or accelerate?
For a robot vacuum: Keep vacuuming, or go back to the charging station?

Branches of Artificial Intelligence

Based on Wikipedia: Artificial Intelligence as of 8 Feb 2019.

Data Mining
Text Mining
Process Mining
Activity Recognition
Image Retrieval
Email Spam Filtering
Named-Entity Extraction
Information Extraction
Knowledge Management & Concept mining

Artificial Creativity
Artificial Life
Automated Planning and Scheduling
Automatic Target Recognition
Automation
Automated Reasoning
Biologically Inspired Computing

Constrained Conditional Models
Deep Learning
Neural modeling fields
Machine Learning

Speech Recognition
Speaker Recognition
Computer Audition

Chatbots
Language Identification
Natural Language User Interface
Natural Language Understanding
Machine Translation
Question Answering
Statistical Semantics
Semantic translation
Natural Language Processing

Image Processing
Intelligent Word Recognition
Object Recognition
Computer Vision
Handwriting Recognition
Optical Character Recognition
Object Mark Recognition
Automatic Number Plate Recognition
Silent Speech Interface
Face Recognition Systems

Nonlinear Control

Diagnosis
Expert System
Decision Support System
Clinical Decision Support System

Optical Character Recognition
Handwriting Recognition
Face Recognition
Speech Recognition
Pattern Recognition

Speech Generating Device
Strategic Planning
Vehicle Infrastructure Integration
Virtual Intelligence
Virtual Reality

Behaviour-based Robotics
Cognitive
Cyberbetics
Developmental robotics
Epigenetic robotics
Evolutionary robotics
Robotics

Hybrid Intelligent System
Intelligent Agent
Intelligent Control
Knowledge Management
Knowledge Representation
Semantic Web

Game AI
Game Theory
Agent architecture
Cognitive architecture
General game Playing
Computer Game Bot
Video Game AI
Computer Chess
Computer Go

Machine Learning Example

- Suppose you wanted to identify fraudulent credit card transactions.

- You could define features to be:
  - Transaction time
  - Transaction amount
  - Transaction location
  - Category of purchase

- The algorithm could learn what feature combinations suggest unusual activity.

Machine Learning Limitations

- Suppose you wanted to determine if an image is of a cat or a dog.

- What features would you use?

- This is where **Deep Learning** can come in.

Dog and cat recognition

What is deep learning?

Deep Learning

"Machine learning that involves using very complicated models called "deep neural networks"." (Intel)

Models determine best representation of original data; in classic machine learning, humans must do this.

ARTIFICIAL INTELLIGENCE
A program that can sense, reason, act, and adapt

MACHINE LEARNING
Algorithms whose performance improve as they are exposed to more data over time

DEEP LEARNING
Subset of machine learning in which multilayered neural networks learn from vast amounts of data
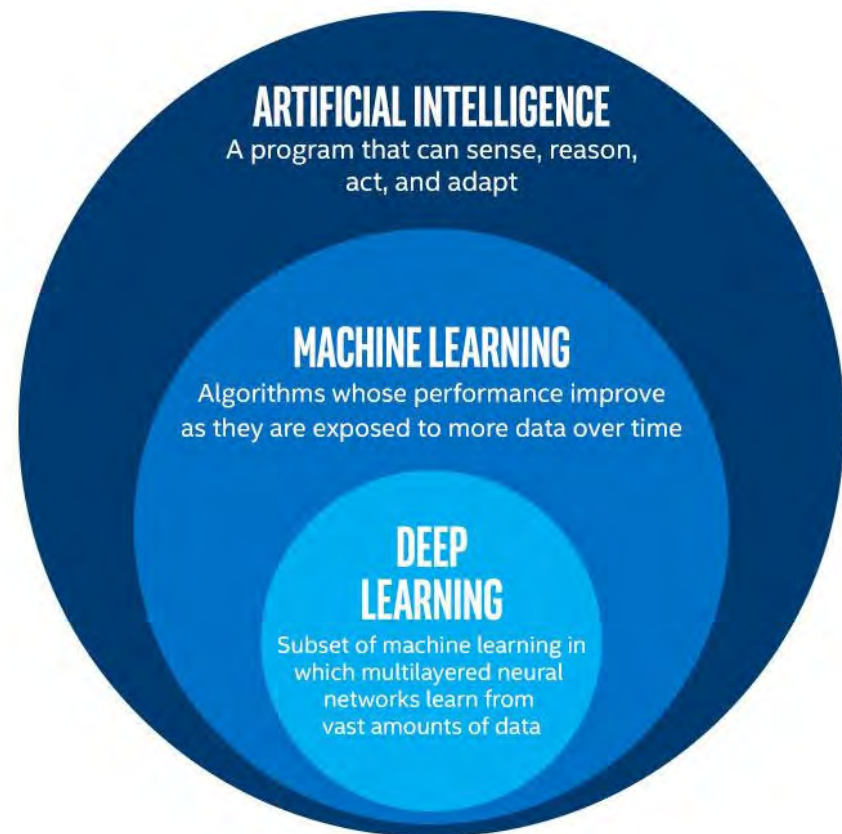
Deep Learning Example

Classic Machine Learning

Step 1: Determine features.
Step 2: Feed them through model.

Feature Detection → **Machine Learning Classifier** → **"David"**
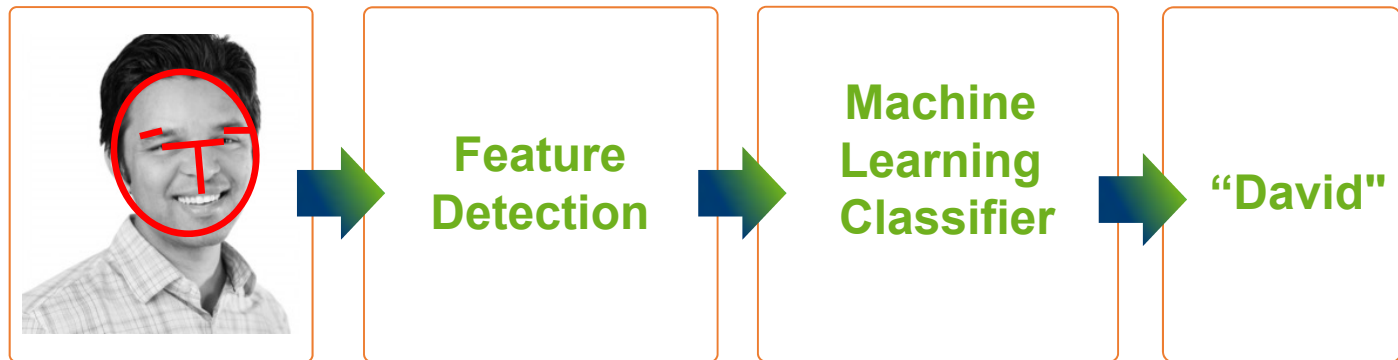
Deep Learning

Steps 1 and 2 are combined into 1 step.

Neural Network

input layer · hidden layer 1 · hidden layer 2 · hidden layer 3 · output layer

→ **"David"**
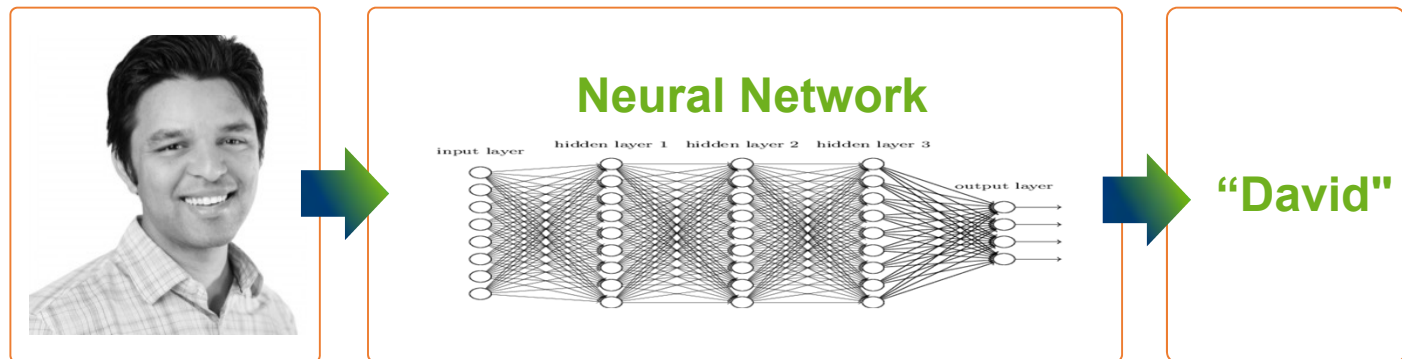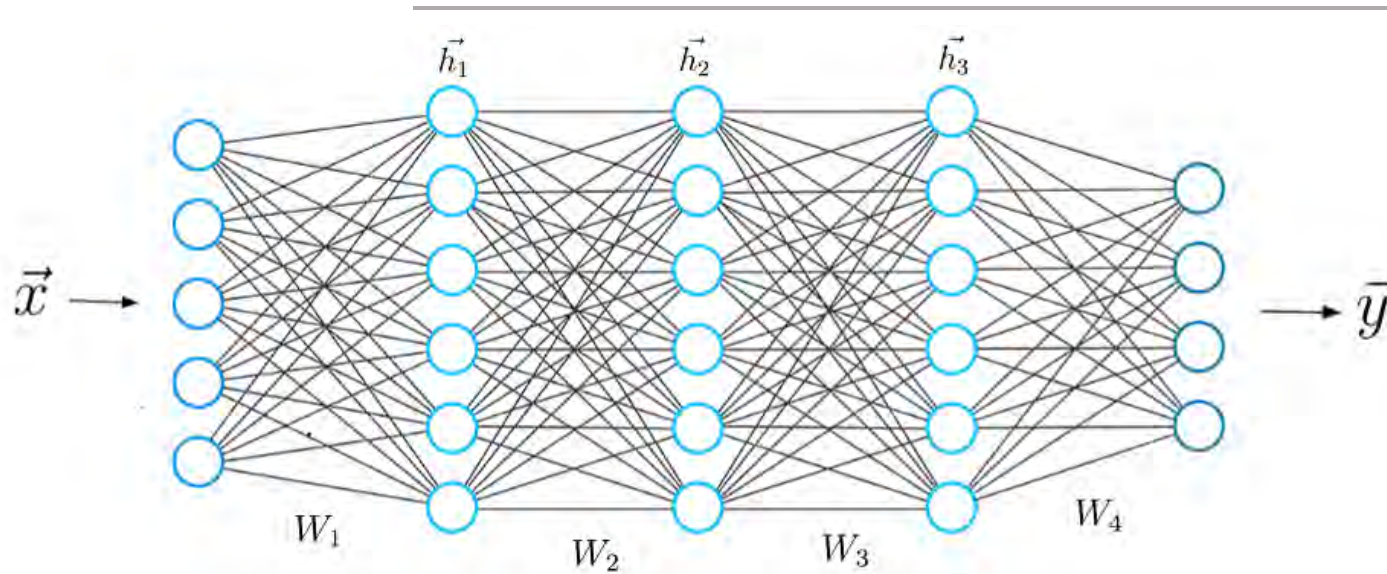
Neural Networks

The challenge in training a neural networks is finding a set of weights the give the most accurate output.
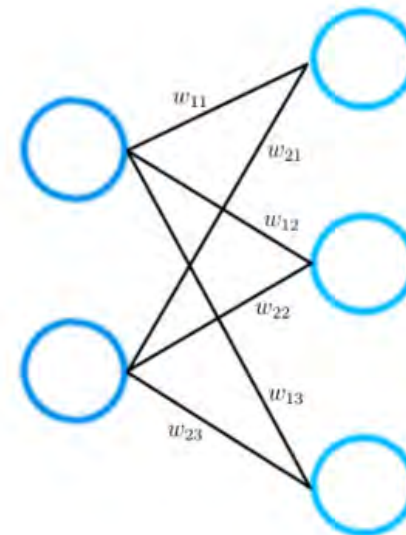
Performance
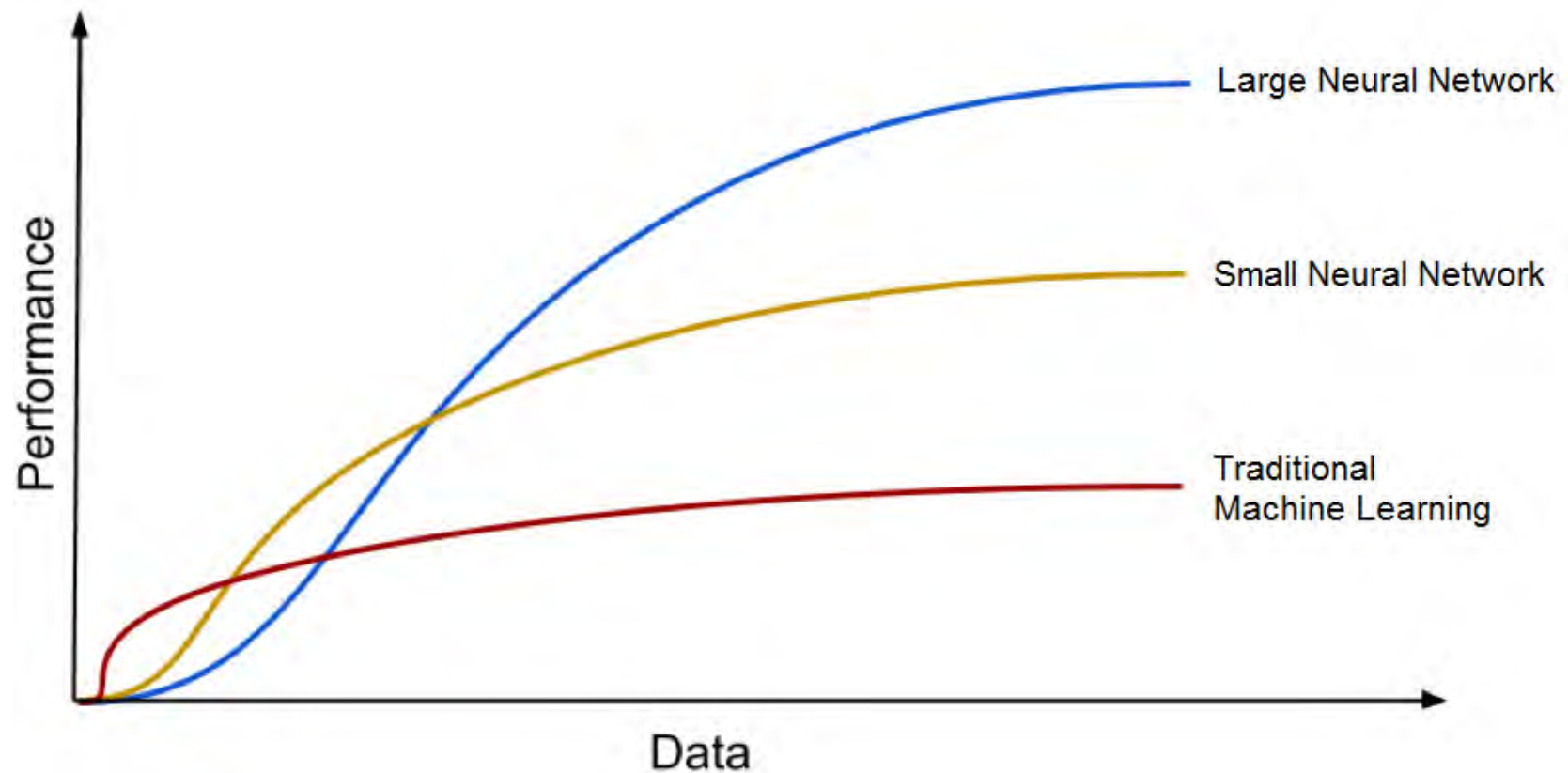
Deep Learning Algorithms get better with the increasing amount of data.

Size
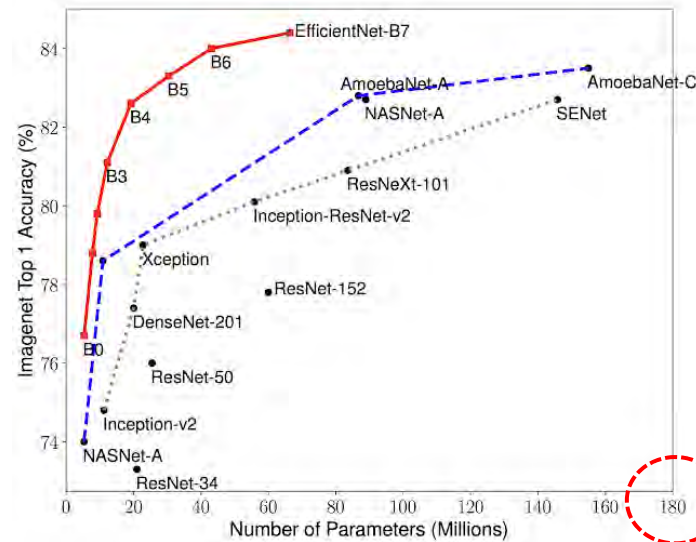
Huge models, large companies and massive training costs dominate the hottest area of AI today, NLP.
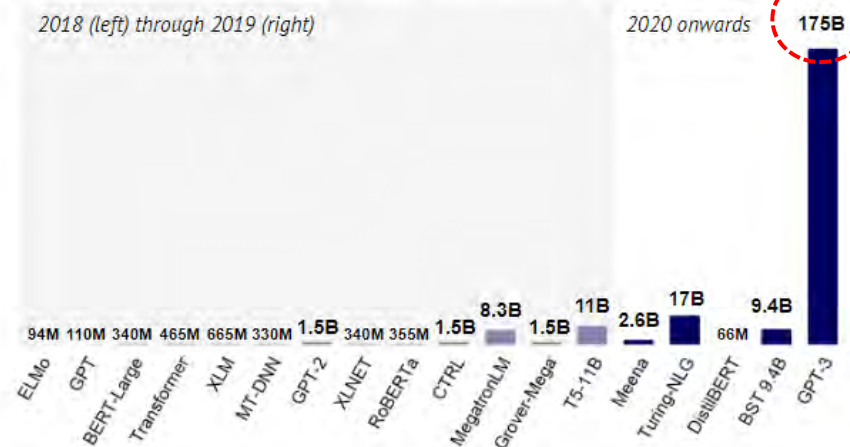
Note: The number of parameters indicates how many different coefficients the algorithm optimizes during the training process.

stateof.ai 2020

Deep Learning in Action

10 mins

bit.ly/google_teachable

Teachable Machine

Train a computer to recognize your own images, sounds, & poses.

A fast, easy way to create machine learning models for your sites, apps, and more – no expertise or coding required.

Get Started
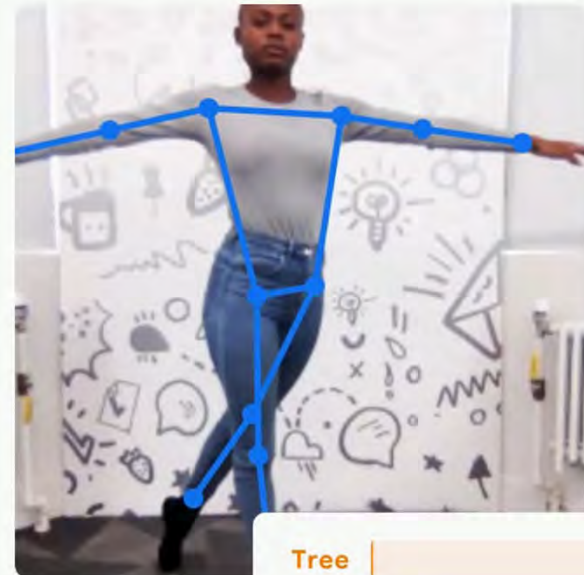
Optional Activity

15 Mins Break

bit.ly/top10_2020

Machine Learning workflow
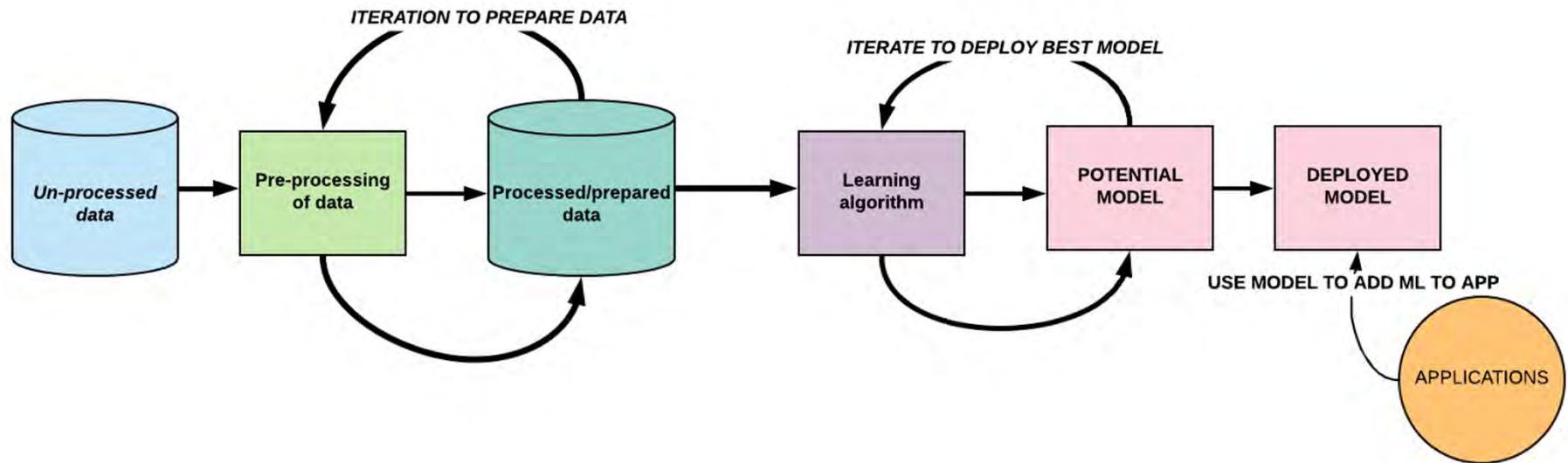
Code-Free Machine Learning tools

Microsoft Azure
Machine Learning Studio
(Classic)
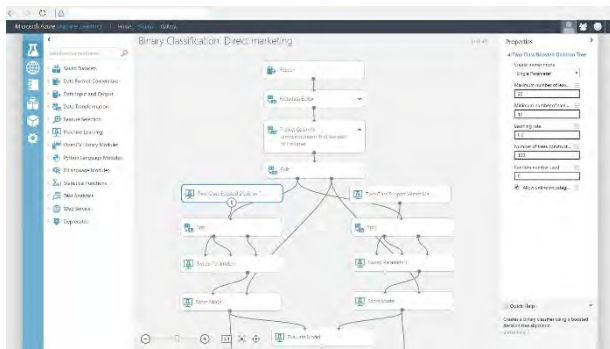
Clarifai
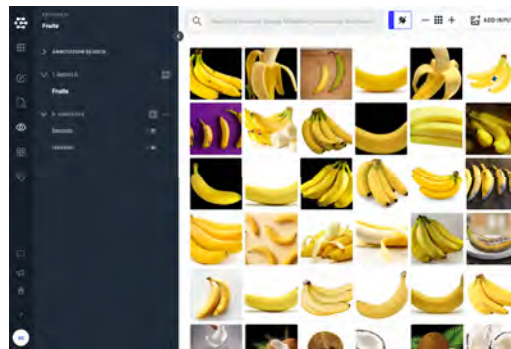
Peltarion

bigml

KNIME
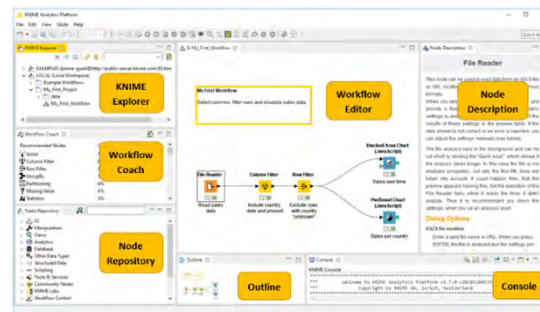
Rapidminer

Activity 1 – First Machine Learning with Azure

- **Automobile Price Prediction**

Given some features of a car, e.g. engine capacity, no of doors, horsepower, predict the selling price

Step 1:
Watch and listen to the instructor's demonstration

30 mins

Step 2:
- Do on your own

Individual Activity

30 mins

28

60 mins Lunch Break

Some interesting videos

https://www.youtube.com/watch?v=bmNaLtC6vkU

https://www.youtube.com/watch?v=Nnf8P5A_saE

Lunch break 12:20-13:20

LUNCH BREAK

Recap
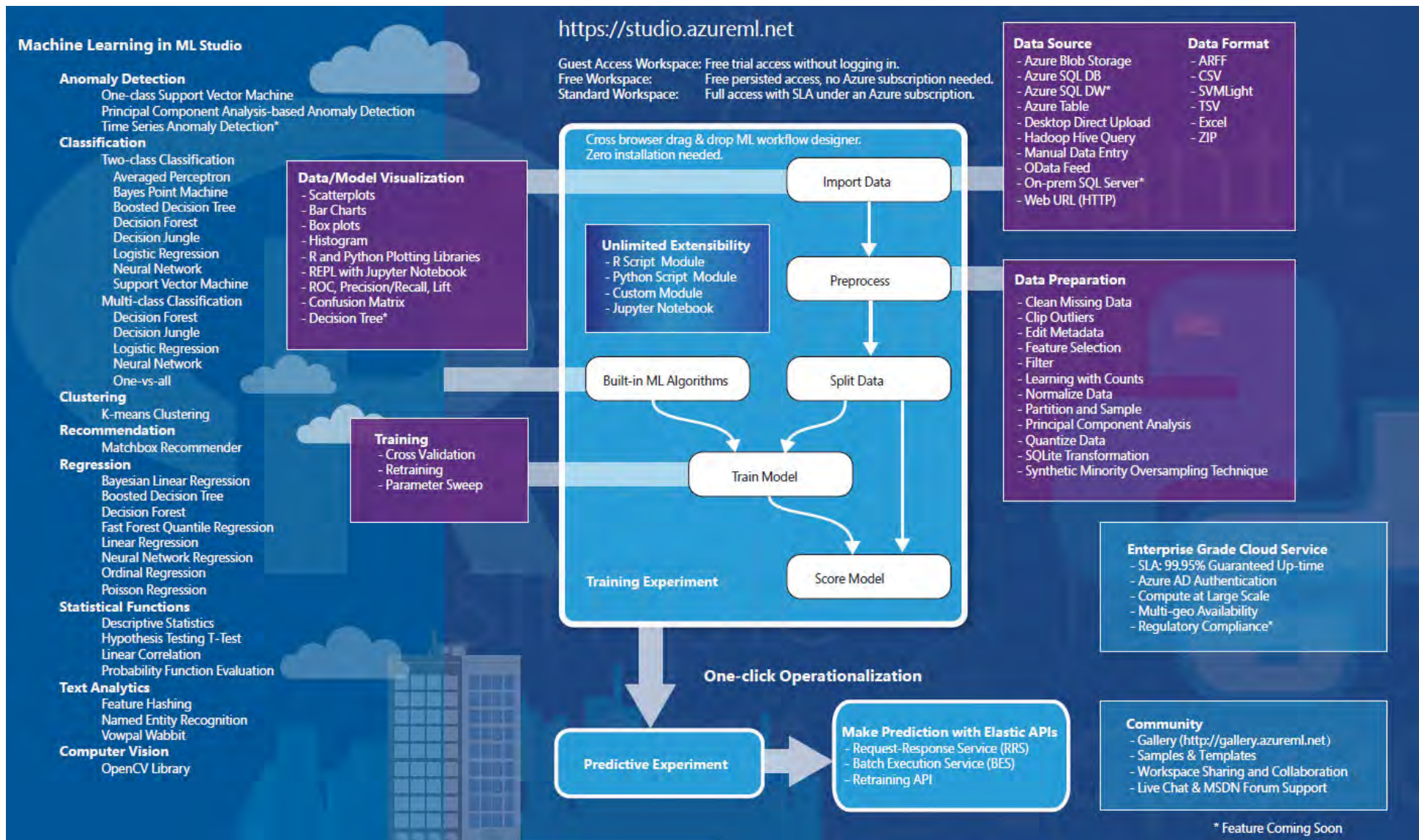
Azure ML Algorithm Cheat Cheet

Microsoft Azure
Machine Learning Algorithm Cheat Sheet

This cheat sheet helps you choose the best machine learning algorithm for your predictive analytics solution. Your decision is driven by both the nature of your data and the goal you want to achieve with your data.

What do you want to do?

Extract information from text

Predict between several categories

Predict between two categories

Generate recommendations

Predict values

Discover structure

Find unusual occurrences

Classify images

Text Analytics
Derives high-quality information from text
Answers questions like: What info is in this text?

Extract N-Gram Features from Text	Creates a dictionary of n-grams from a column of free text
Feature Hashing	Converts text data to integer encoded features using the Vowpal Wabbit library
Preprocess Text	Performs cleaning operations on text, like removal of stop-words, case normalization
Word2Vector	Converts words to values for use in NLP tasks, like recommender, named entity recognition, machine translation

Regression
Makes forecasts by estimating the relationship between values
Answers questions like: How much or how many?

Fast Forest Quantile Regression	Predicts a distribution
Poisson Regression	Predicts event counts
Linear Regression	Fast training, linear model
Bayesian Linear Regression	Linear model, small data sets
Decision Forest Regression	Accurate, fast training times
Neural Network Regression	Accurate, long training times
Boosted Decision Tree Regression	Accurate, fast training times, large memory footprint

Recommenders
Predicts what someone will be interested in
Answers the question: What will they be interested in?

SVD Recommender	Collaborative filtering, better performance with lower cost by reducing dimensionality

Clustering
Separates similar data points into intuitive groups
Answers questions like: How is this organized?

K-Means	Unsupervised learning

Anomaly Detection
Identifies and predicts rare or unusual data points
Answers the question: Is this weird?

One Class SVM	Under 100 features, aggressive boundary	PCA-Based Anomaly Detection	Fast training times

Multiclass Classification
Answers complex questions with multiple possible answers
Answers questions like: Is this A or B or C or D?

Multiclass Logistic Regression	Fast training times, linear model
Multiclass Neural Network	Accuracy, long training times
Multiclass Decision Forest	Accuracy, fast training times
One-vs-All Multiclass	Depends on the two-class classifier
Multiclass Boosted Decision Tree	Non-parametric, fast training times and scalable

Two-Class Classification
Answers simple two-choice questions, like yes or no, true or false
Answers questions like: Is this A or B?

Two-Class Support Vector Machine	Under 100 features, linear model
Two-Class Averaged Perceptron	Fast training, linear model
Two-Class Decision Forest	Accurate, fast training
Two-Class Logistic Regression	Fast training, linear model
Two-Class Boosted Decision Tree	Accurate, fast training, large memory footprint
Two-Class Neural Network	Accurate, long training times

Image Classification
Classifies images with popular networks
Answers questions like: What does this image represent?

DenseNet	High accuracy, better efficiency

Microsoft

Activity 2

- Deploying your experiment as a Web Service & Make Prediction using Excel

Step 1:
Watch and listen to the instructor's demonstration

15 mins

Step 2:
Work through the activities

30 mins

Individual Activity

Optional Activities

- Activity 6 - Importing data
- Activity 7 - Cleaning and Structuring Data
- Activity 8 - Using Binary Classification Algorithm

Applications of Computer Vision

- Image Classification

- Image Classification With Localization

- Object Detection

- Object Segmentation

https://machinelearningmastery.com/applications-of-deep-learning-for-computer-vision/

34
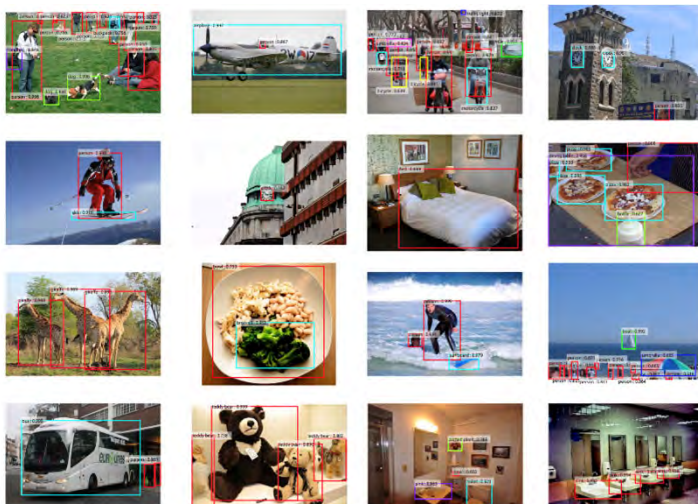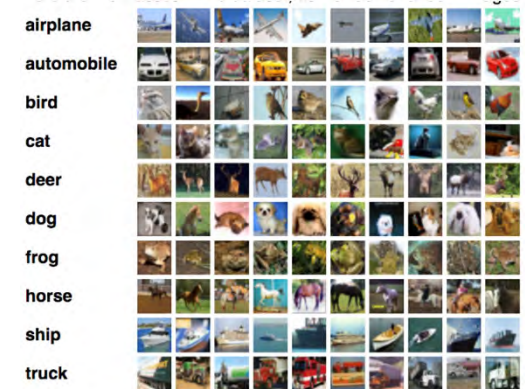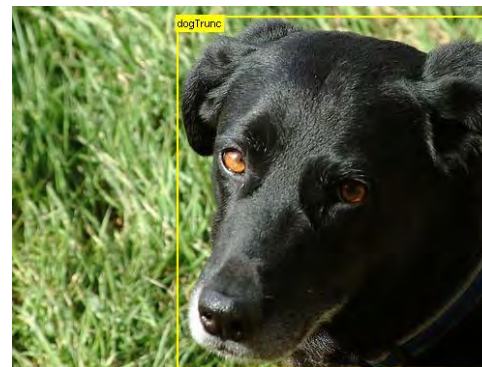
Applications of Computer Vision

- Image Style Transfer
- Image Colorization
- Image Reconstruction
- Image Super-Resolution
- Image Synthesis
- Other Problems
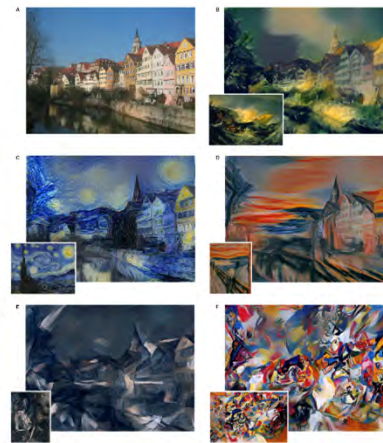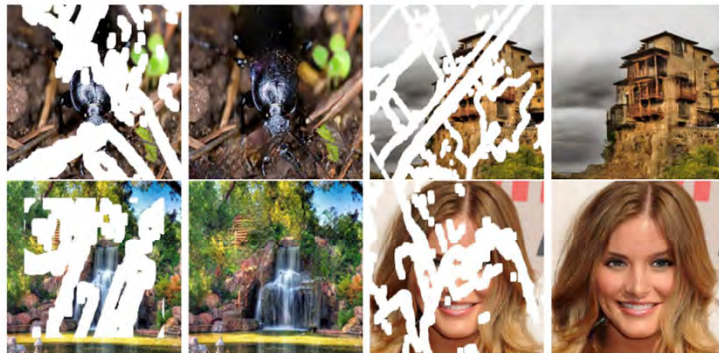
Transfer Learning

Humans have an inherent ability to transfer knowledge across tasks.

What we acquire as knowledge while learning about one task, we utilize in the same way to solve related tasks.

The more related the tasks, the easier it is for us to transfer, or cross-utilize our knowledge.

Some simple examples would be,
* Know how to ride a motorbike ➡ Learn how to ride a car
* Know how to play classic piano ➡ Learn how to play jazz piano

- **Models are difficult to train from scratch**
  - Huge datasets (like ImageNet)
  - Long number of training iterations
  - Very heavy computing machinery
  - Time experimenting to get hyper-parameters just right

Transfer Learning

Creating a new dataset

Step 1
- **Data acquisition**
  - Take pictures of the subject. Try to position subject in the middle of the image.
  - Import all images to your computer in a folder named MyImages.

Step 2
- **Data preprocessing**
  - **Resize images to 224x224 pixels**
  - **Label all images**

Step 3
- **Create csv file**
  - **Create a text file with all image names**
  - **Create a file with all labels**
  - **Combine image names and labels in one file - index.csv**

Step 4
- **Create the zip-file**

https://peltarion.com/knowledge-center/documentation/datasets-view/example-workflows---datasets-view/create-new-dataset-/-example-workflow

Example

Activity 3 – Car Damage Classifier

Broken headlamp

Broken tail lamp

Glass shatter

Door scratch

Door dent

Bumper dent

Bumper scratch

Unknown

Step 1:
Watch and listen to the instructor's demonstration

20 mins

Step 2:
- Do on your own

Individual Activity

30 mins

40

15 Mins Break

bit.ly/google_duplex2019
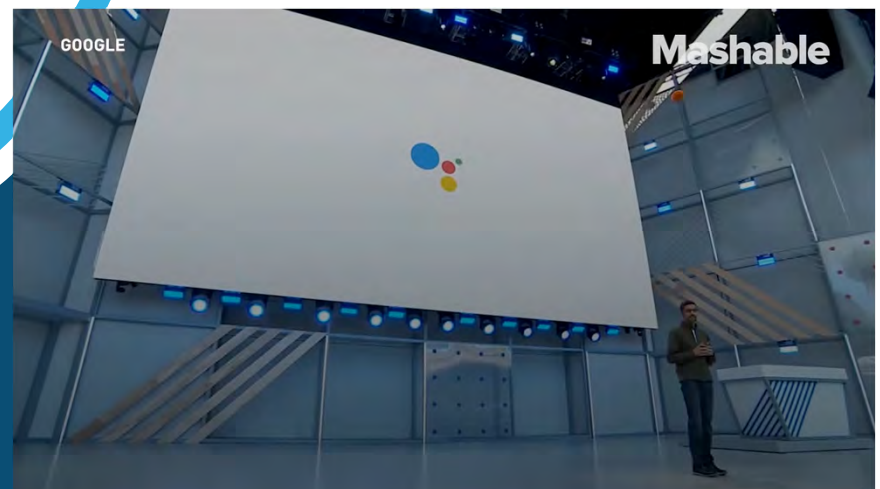
Natural Language Processing

- Search Autocorrect and Autocomplete
- Language Translator
- **Social Media Monitoring**
- Chatbots
- **Survey Analysis**
- Targeted Advertising
- Hiring and Recruitment
- Voice Assistants
- Grammar Checkers
- Email Filtering

https://www.analyticsvidhya.com/blog/2020/07/top-10-applications-of-natural-language-processing-nlp/

Dataset

review	sentiment
Encoding Text	Encoding Binary Positive class positive
1. Hubert Selby Jr. gave us the book "Requiem For A Dream" and co-wrote the screenplay to Aronofsky's movie of it. That movie succeeded on every level by delivering an intimate, and unbiased portrait of the horrors of the characters lives and the vices that destroyed them. "Last Exit To Brooklyn" still has the vice and the multiple characters living sad lives, but it hardly does them the same justice Aronofsky did. The film seems laughably anti-gay at times. Especially when in the film homosexuality equals death. One gay character gets stoned, is launched skyward by a speeding car, and lands dead on the pavement. Another is crucified and still more are simply beat up. Another exaggerated piece of shock value, that might actually hav…	negative
2. There are very few performers today who can keep me captivated throughout an entire film just by their presence. One of those few is Judy Davis, who has built a successful career out of creating characters that are headstrong in attitude but very vulnerable at heart. She takes roles that most other performers would treat melodramatically and adds a fiery, deeply emotional intensity that pulls attention away from everything else on the screen. Her skills are well displayed in "High Tide," a film that matches her up a second time with director Gillian Armstrong, who gave Davis her first major success with "My Brilliant Career." In that film, Davis played a young woman who was determined to make it in the world, despite the suffocat…	positive
3. C'mon guys some previous reviewers have nearly written a novel commenting on this episode. It's just an old 60's TV show ! This episode of Star Trek is notable	negative

Information

Creator	-
Features	**Review, Sentiment**
Rows	**25 000**
Size	**13 MB**
Categories	**Text, Classification**

Activity 4 - Creating a Sentiment Analyser

About this dataset

This dataset contains textual movie reviews from IMDB users, together with the rating (simplified as positive or negative) that the user gave to the movie.

Inspiration

Use this dataset to predict a simple positive or negative category from paragraph-sized text data.

Step 1:
Watch and listen to the instructor's demonstration

20 mins

Step 2:
- Do on your own

40 mins

Individual Activity
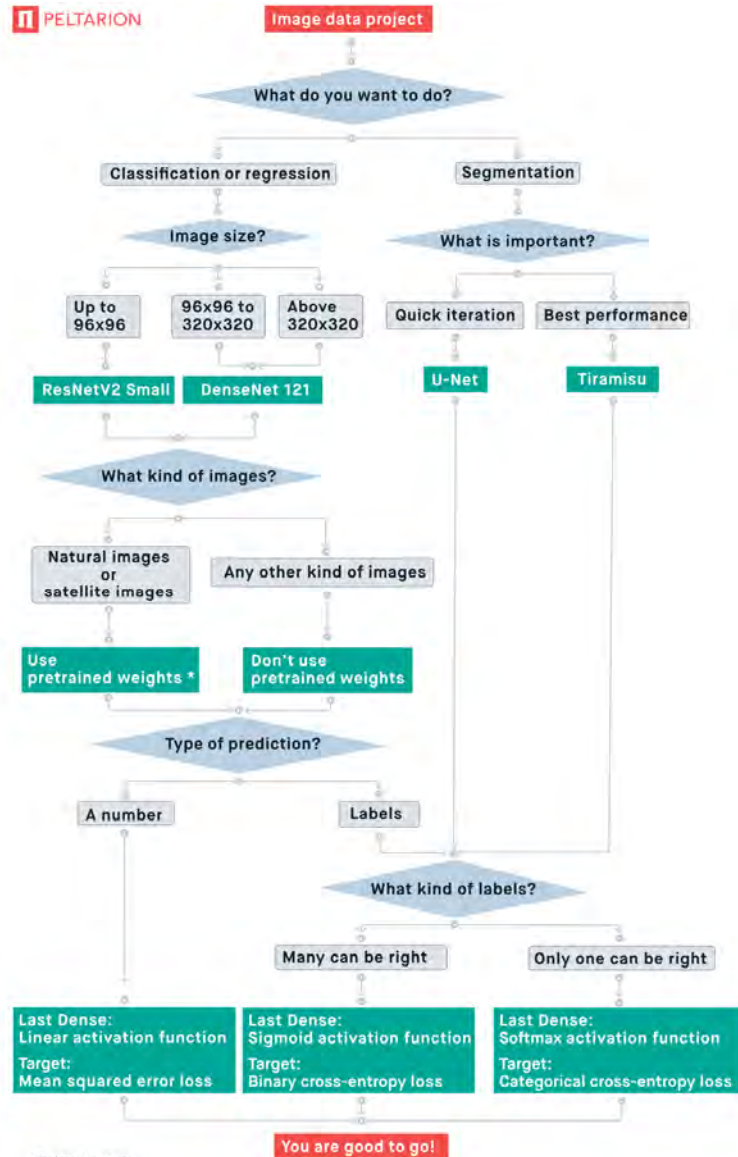
44

Cheatsheets

https://peltarion.com/knowledge-center/documentation/cheat-sheets

Linking Them Together

App Development

Top 9 No-Code Web App Development Tools that May Compete with Bubble

We're here to prove that **"building the best product"** is possible not only with Bubble.

Airtable .bubble webflow

https://uibakery.io/bubble-alternatives
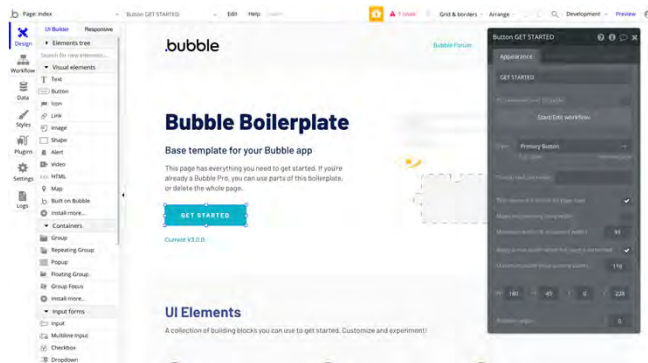
RPA

Integrated System of Intelligence With Artificial Intelligence, Machine Learning and Natural Language Processing

UiPath WorkFusion blueprism

Adobe Acrobat Document

https://www.youtube.com/watch?v=FV8IM9SIFQ8
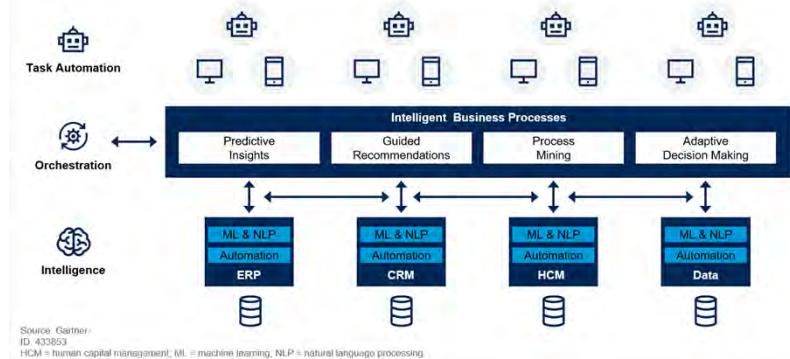
When to use Machine Learning

- **What are our most pressing problems right now?**
  - Just like any other tool in business, AI should be viewed as a tool that can help make your organization more effective, profitable or streamlined

- **What parts of our business generate revenue but currently have low profit margins?**
  - These revenue streams could provide fertile ground for automation and acceleration via AI.

- **Where would we like to cut costs?**
  - Review your costs and pinpoint the ones you'd like to reduce. AI can help you better understand what generates costs and identify areas that could be optimized or changed to reduce them.

- **Where do we make a high percentage of errors in our work?**
  - A well-trained AI model has the capacity to perform with far less margin of error than humans

- **What work do our employees do that they don't particularly like?**
  - If it's repetitive or annoying for a human to do, there might be a component of the task better done by AI.

Ref: The essential AI Handbook for leaders   47

Some easy readings

THE ESSENTIAL AI HANDBOOK FOR LEADERS

FOREWORD BY MARCUS WALLENBERG

AT THE END OF THE DAY it is not technology that creates success, it is people. It is leaders that take the right decisions based on the most accurate data, insights and their ability to work with the best people. It is the ones who do this faster than the competition that will succeed.

ALGORITHMIA
2020 state of enterprise machine learning

O'REILLY®
AI Adoption in the Enterprise 2020
Roger Magoulas & Steve Swoyer
RADAR REPORT

Datasets and Data Prep

GitHub

https://kwseow.github.io/

Google Dataset Search Beta

https://datasetsearch.research.google.com/

kaggle

https://www.kaggle.com/datasets

KDnuggets™

https://www.kdnuggets.com/datasets/index.html

X Excel **+ableau°** **Microsoft Power BI** **roboflow**

Debrief

Step 1: Go to the following url

http://bit.ly/cfml_debrief

Step 2: facilitator will walk you through the following

1) **Share 1 insight that you gained from this workshop.**

2) **Share 1 project that you may want to work on.**

3 mins

Quiz

https://bit.ly/kw_poll

SCAN ME

Survey

https://bit.ly/2UvFXfK

Summary

Email
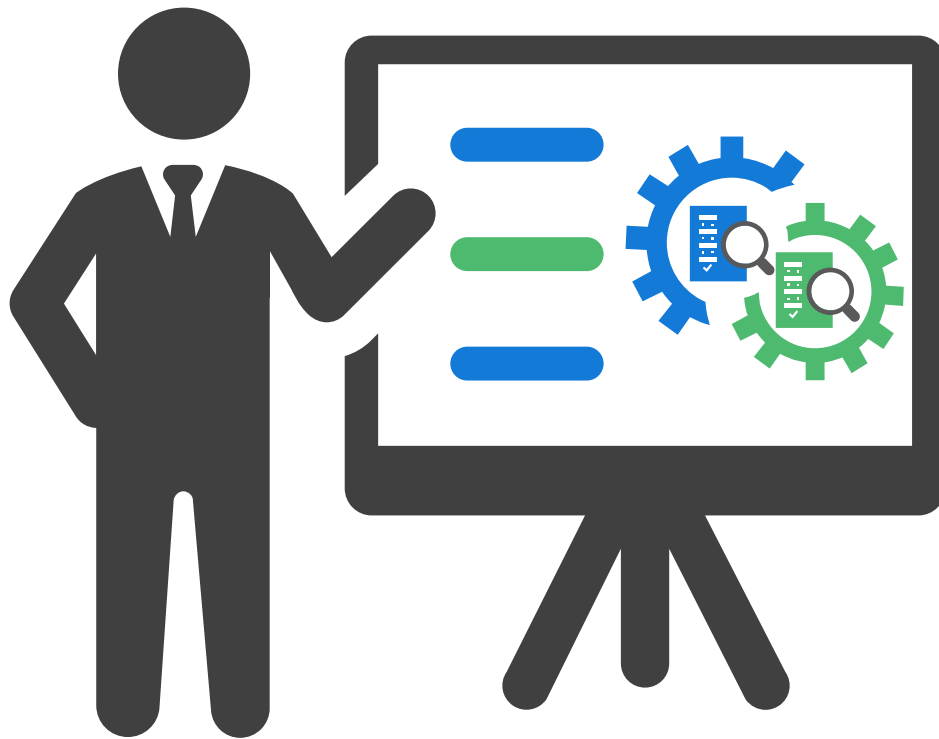seow_khee_wei@rp.edu.sg

Telegram
@kwseow

Source code:

Thank you