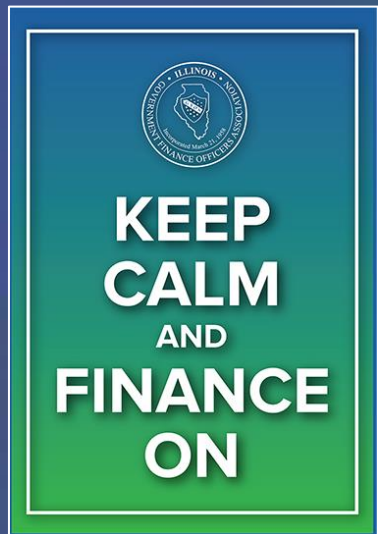


# Automation In The Accounting Profession

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# Learning Objectives / Overview

- Data Analytics
  - Understand basics of data analytics
  - Introduction to business intelligence software
- Artificial Intelligence (AI)
  - Understanding fundamentals of artificial intelligence
- Machine Learning (ML)
  - Dive into the principles of machine learning and its subcomponents
- The relationship between data analytics, artificial intelligence and machine learning
- Demonstrate existing accounting and finance software with the above features

# Machine Learning and Data Automation in Finance and Accounting

- Existing processes are moving paperless allowing for more machine involvement
- Benefit of machine learning and business intelligence tools
  - Reduce time spent on manual processes
  - Improved accuracy
  - Remove human error element
  - More time to analyze results and identify anomalies and less time manipulating data
- Accounting and finance individuals are in a unique position
  - Current processes will become more automated (reduced manual work)
  - Our experience working with formatting data, analyzing results and using tools like excel will reduce the AI learning curve
  - Accounting and finance can be integral to a government's AI transformation and innovation
- Embrace the benefits of artificial intelligence

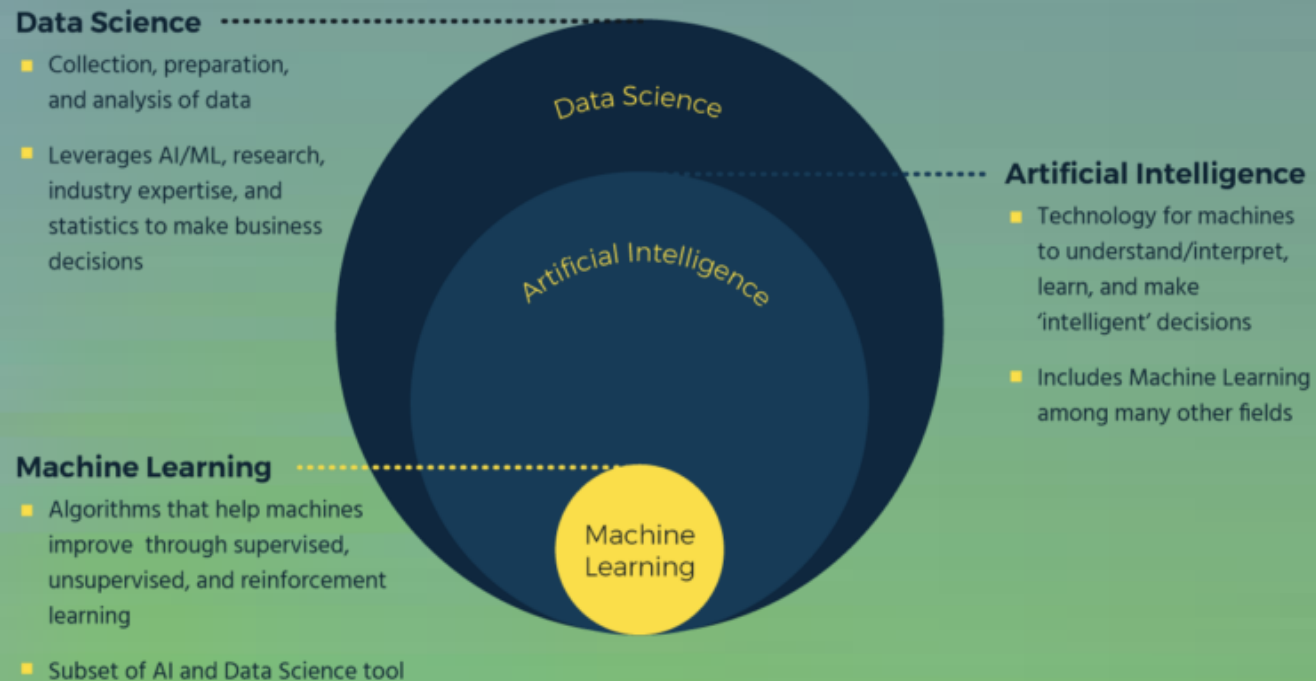
# Finance and Accounting business processes ripe for automation

- Account reconciliations (i.e. Floqast)
- Processing and recording invoices (i.e. Bill.com)
- Preparing internal financial statements and ability to easily analyze data (i.e. business intelligence software)
- Recording and coding of cash receipts (i.e. bank rules)
- Budgeting, forecasting and modeling
- Cash application

# Relationship between Data Analytics, AI & ML

The following charts illustrates the relationship between data analytics, AI and ML

## AI vs. Data Science vs. Machine Learning



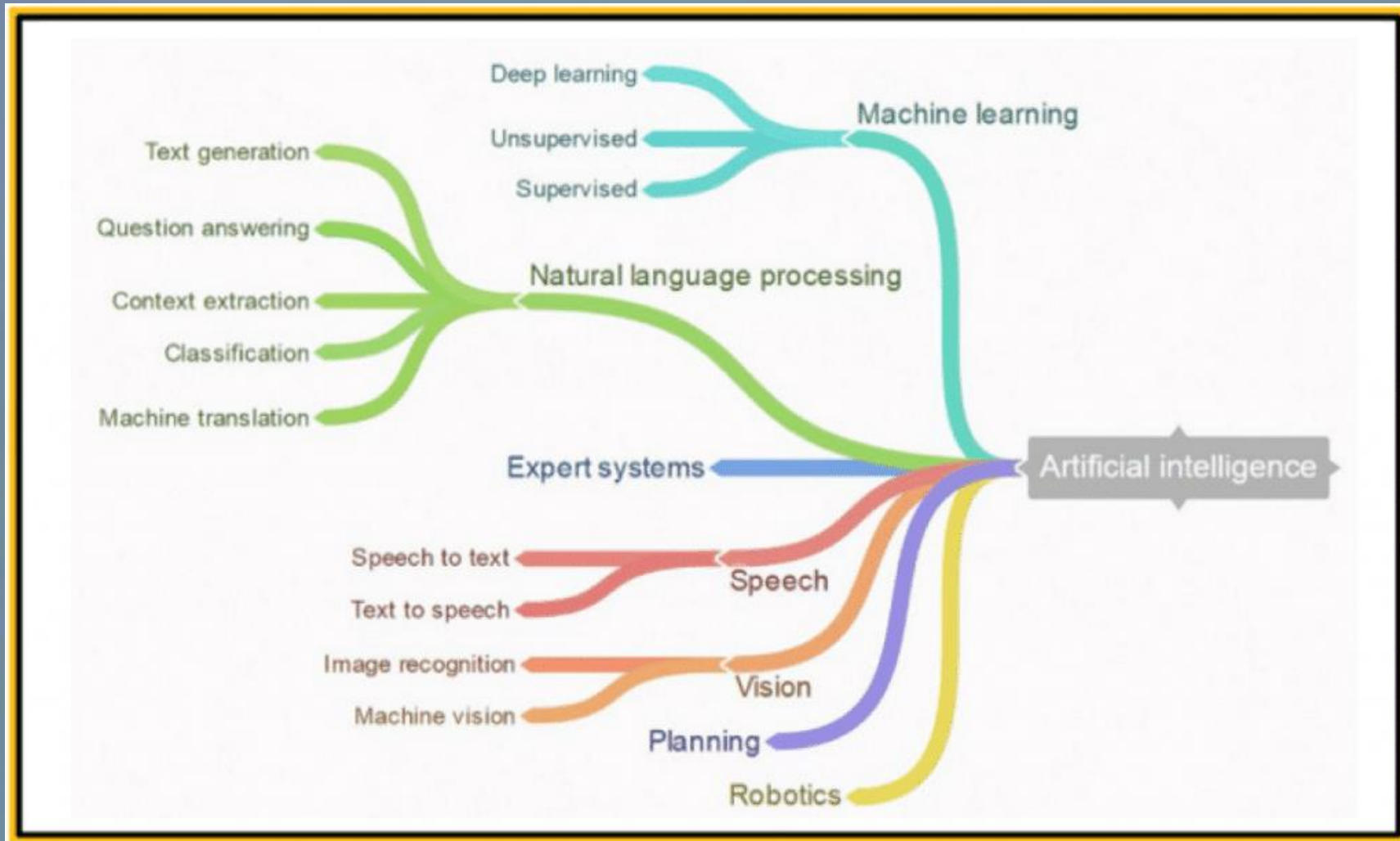
# Fundamental of data analytics

- Data analytics is the process of inputting, process and analyses of data, i.e. analyzing general ledger data to understand underlying activity
- Data analytic workflow (concept applies to the entire scope of data science)
  - Preparation – Compiling data, ensuring integrity and formatting
  - Analysis – Using computer programs, i.e. excel, PowerBi, ML algorithms to analyze data
  - Reflection – Critical analysis and understanding results
  - Dissemination – Concluding and presenting results
- In the analysis phase artificial intelligence tools can enhance the analysis, reduce time, better understand correlations in data and improve results

# Business Intelligence (BI) Software

- BI software aids in the analysis and preparation phase.
- Benefits of BI Software's
  - Allows for storage and analysis of very large sets of data (i.e. millions of rows)
  - Automate retrieving data from data warehouses (sequel)
  - Automates the data formatting, calculations and report preparation
  - Easy to create visualizations, i.e. charts, tables, graphs, and other reporting features
  - Allows user to quickly drill down and analyze underlying detail
  - Modeling / Forecasting
- BI Tools
  - Microsoft PowerBi (cheapest version)
  - Tableau
  - Oracle OBIEE
  - IBM Cognos
  - S&P

# Scope of Artificial Intelligence



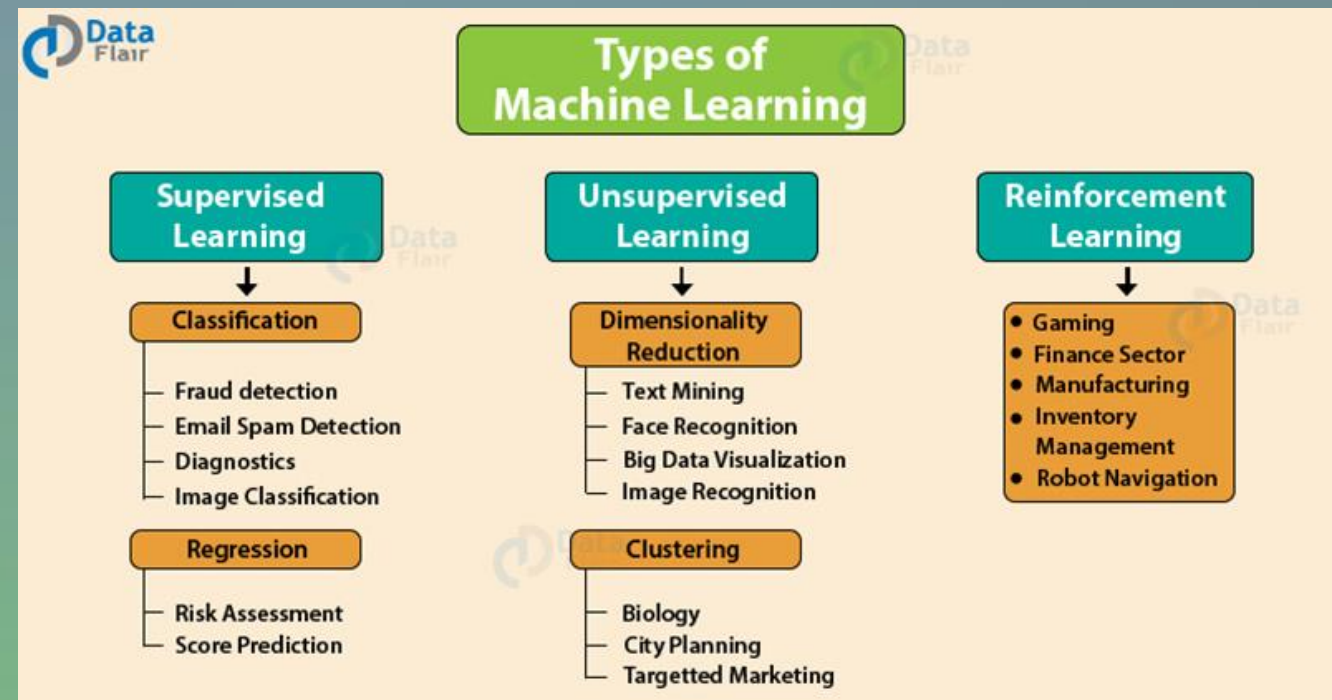


# Artificial Intelligence Fundamentals

- Broadly defined as “bringing intelligence to machines”
- Basic AI tools evident in our everyday lives includes
  - Manufacturing Robotics,
  - Siri,
  - Alexa,
  - Driving assisted vehicles,
  - Telephone or online help robots
- Limitations in non-ML tools:
  - Rules based (think if statements in excel),
  - Requires involvement of programmers to provide precise instruction (the closer you are to the programmer the less it feels like artificial intelligence, more inefficient and time consuming)
  - These machines lack the ability to learn from experience
- Problem: Impossible to define every rule and iteration
- Resolution: Machine learning allows the machine to evolve, learn from experience and limit involvement in the programmer

# Machine Learning Fundamentals

- Since the Industrial Revolution humans have engineered machines to enhance physical activities (i.e. recognize voices, read text, robotics to move inventory in manufacturing lines, heavy equipment to build infrastructure, etc.)
- Machine learning brings decision making and human intelligence to machines
- A component of artificial intelligence
- Goal of machine learning, create an algorithm that can be trained using data to identify patterns.
- As a we feed more data and information to the algorithm it learns from experience
- ML is broad but broken into two primary categories
  - Supervised learning
  - Unsupervised learning

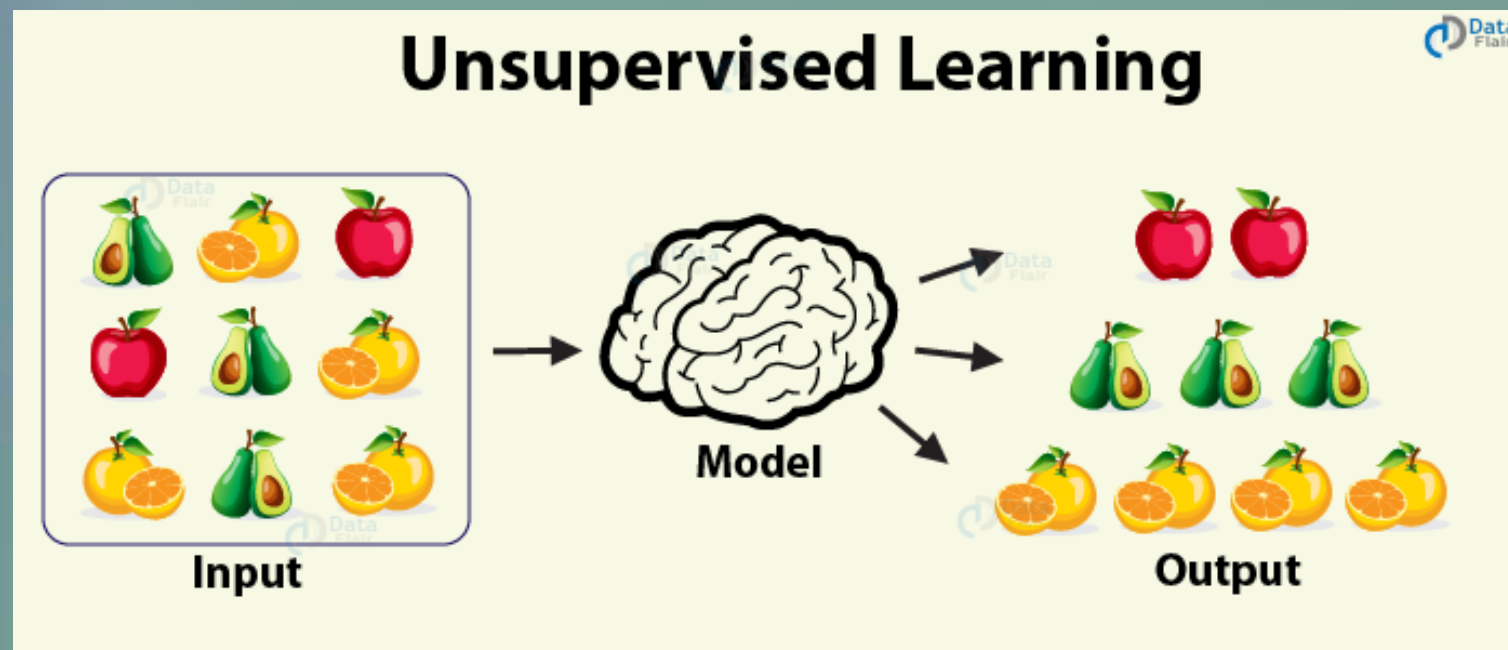


# Supervised Learning

- Supervised Learning more widely used than unsupervised learning (example Bill.com)
- What is supervised learning?
  - Requires precise mapping between input-output data
  - The user trains the machine to classify or identify relationships and the machine trains the algorithm
    - For example: we train machine to recognize vendor name, date, amount, accounting recording and the machine will train the algorithm to scan the invoice, record all invoices from CLA to accounting expense and record the entry on the date of the invoice
- Pros – Tends to be more accurate than unsupervised
- Cons – Training data set's takes time and there is an initial upfront cost. Appropriate planning is required

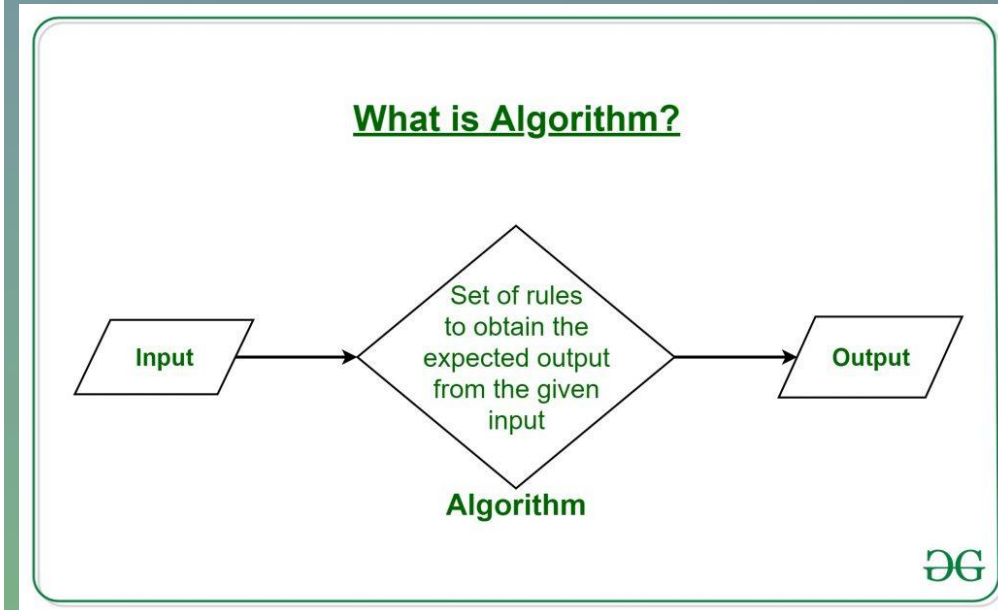
# Unsupervised Learning

- In the case of an unsupervised learning algorithm, the input is not labeled
- The model learns from the data by finding implicit patterns.
- Clustering, also known as cluster analysis, is a technique of grouping similar sets of objects in the same group
- Pros – limited start-up cost and effort to implement, helpful to identify patterns, labels the data for you
- Cons – tends to be less accurate and the user needs to continually feed data to evolve the model.



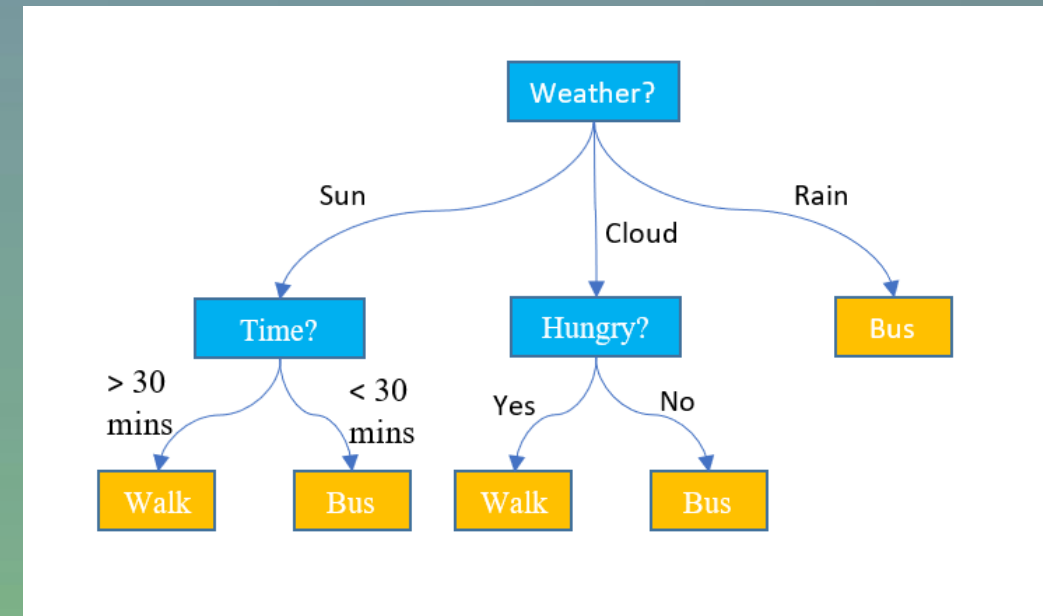
# What is an Algorithm?

- Algorithms are driving the results in machine learning so what is an algorithm?
  - Set of rules to identify an output
- Broken down into three steps
  - Input – Any set of data or information no different than an excel table. For example, an invoice will have a date, vendor name, amount, invoice number
  - Algorithm – set of rules (think if statements in excel). If this is an expense from ClayCo over \$5,000 capital asset under \$5,000 repairs and maintenance
  - Output or results – How the invoice should be recorded
- As the machine learns (supervised or unsupervised) it adds rules
- As the algorithm learns more rules it identifies more patterns and can draw more accurate results



# Types of Algorithm's

- Different types of algorithms
  - Regression – using statistical formulas to identify relationships (i.e. using ML to scan several year of financial data to identify variability in expenses for budgeting)
  - Decision trees – two possible outcomes (see graph), used for supervised learning
  - Random forest – multiple decision trees to create complex models
  - Reinforcement learning – providing the machine with positive or negative feedback (Bill.com)
  - Clustering – Used in unsupervised learning, machine identifies all possible iterations and groups data based upon similarities
  - Artificial Neural Networks (see second slide)



# Deep Learning and Neural Networks

- Arguably the most exciting and innovative ML approach
- History
  - Two individuals (computer science and neuroscientist) created a mathematical formula to create an artificial neuron
  - These artificial neurons are stacked and creates a network
  - This network represents an artificial human brain
- Artificial neuron's use the concept of logistic regression to create a mathematical equation to mimic neurons in the brain (i.e. a single Lego)
- Neurons are stacked in layers to create a Lego set that mimics the decision making of a human brain
- Each of these layers provides a result and the machine uses the collective info to decide
- Only problem, deep learning is expensive

# Deep Learning and Neural Networks (continued)

- How does it work for facial recognition?
  - Breaks images into pieces (i.e. pixels)
  - The machine prioritizes the data based upon hierarchy
  - Artificial neurons are used to identify combinations (i.e. first layer might a round object, second layer combining lines to identify if it has a nose or eyes, etc.)
  - Final output (is the image a face or something else)
- The significant number of layered neurons is why it is called “deep” learning



# How is AI used everyday

- **Healthcare:** Google has developed a new Deep Learning algorithm. This algorithm does a retinal scan (back of the eye) of the patient. Using the data, it can predict any heart diseases.
- **Banking:** The ML algorithms helps prediction future stock prices helping investors spot trends and opportunities.
- **Manufacturing:** Machine learning robotics in the manufacturing process.

# How governments are currently using Automation

- In April 2020, The Illinois Department of Employment Security leveraged AI and ML voice recognition tools to help with the flood of unemployment questions
- Bellevue Washington using
- City of Pittsburg used AI tools to assist with traffic flow and managing traffic stops. Resulting 40% reduction in average travel time.
- HHS, DHS, DOT, EPA and HUD leverage AI tools, such as grant solutions, to automate grant monitoring and reporting
- State of Wisconsin using AI and ML to help automate and analyze unemployment insurance claims.
- AI for performing automated audits allowing for 100% coverage, instead of sampling.
- Automated procurement card spending analysis (demonstrated model).
- Automated internal reporting using Business Intelligence software (demonstrated model).

# Demonstration of Learning Objects in Current Finance and Accounting Tools