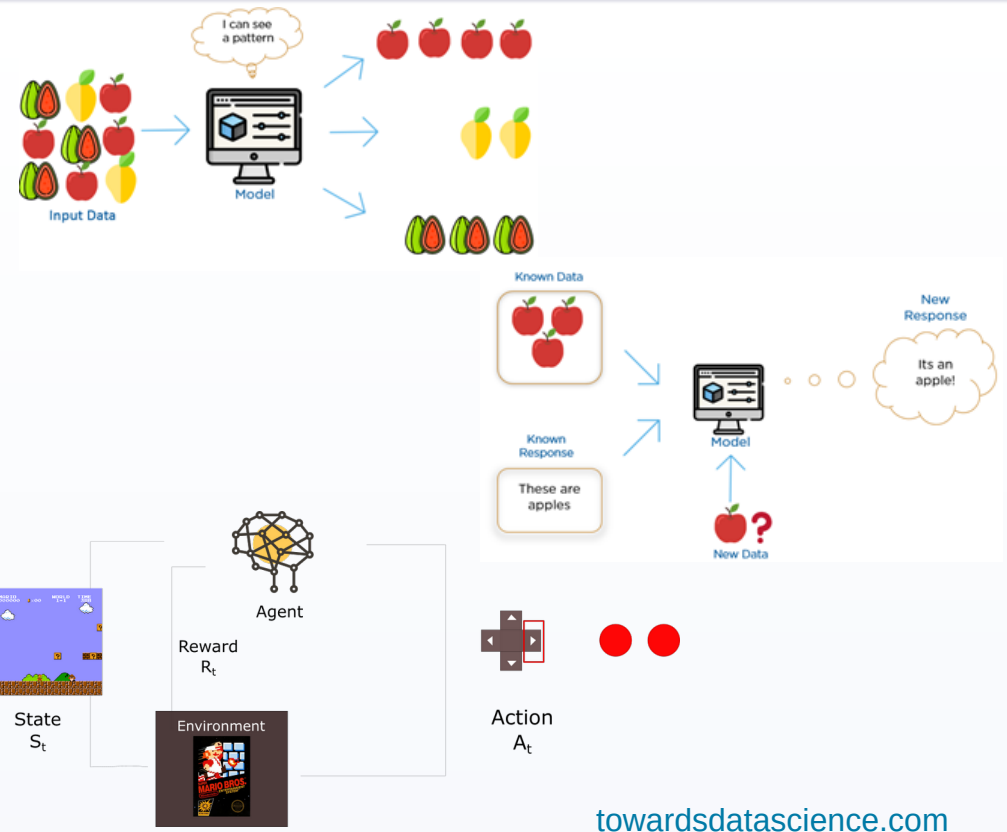


# EGM702 – Photogrammetry and Advanced Image Analysis

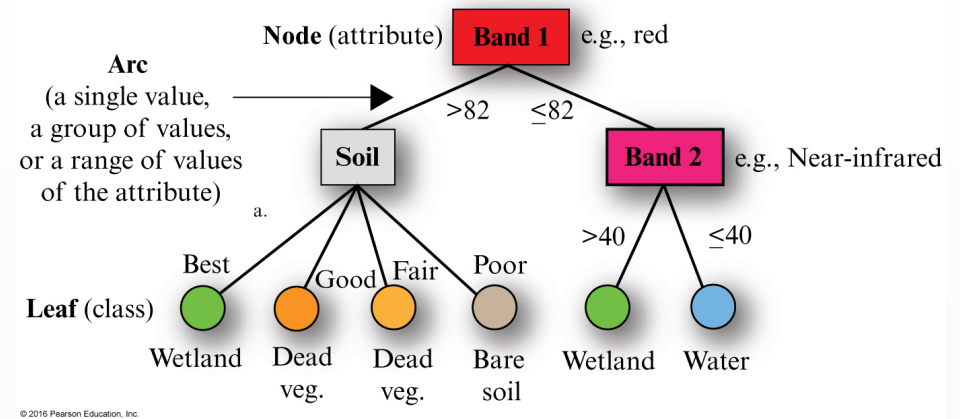
Week 5, Part 4: Machine Learning Classification Techniques

- Machine learning approaches:
  - Unsupervised
  - Supervised
  - Reinforcement learning
- Most prevalent: supervised learning



[towardsdatascience.com](https://towardsdatascience.com)

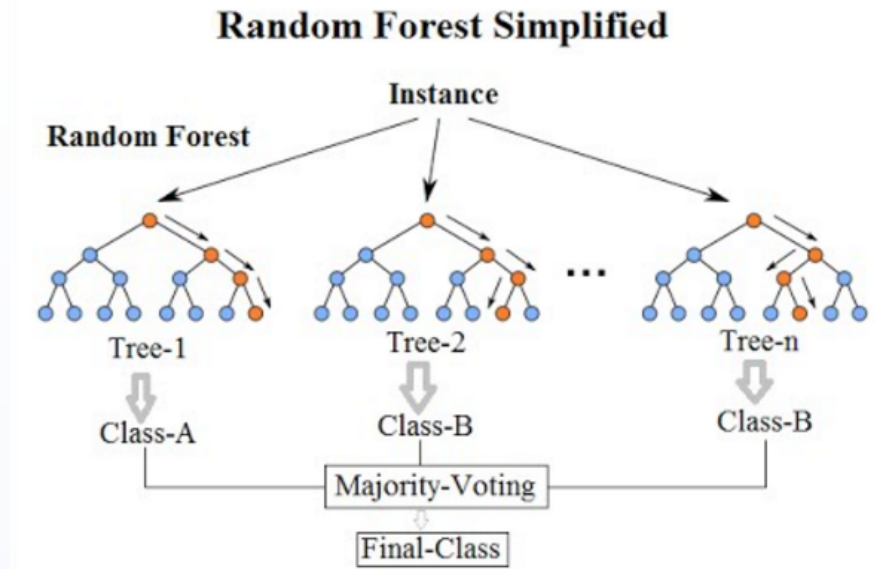
- Similar to a flowchart
  - Node: test of an attribute
  - Branch: test outcome
  - Leaf Node: class label
- Recursively partitions dataset into more homogenous subsets
  - i.e., takes objects as input, returns classes



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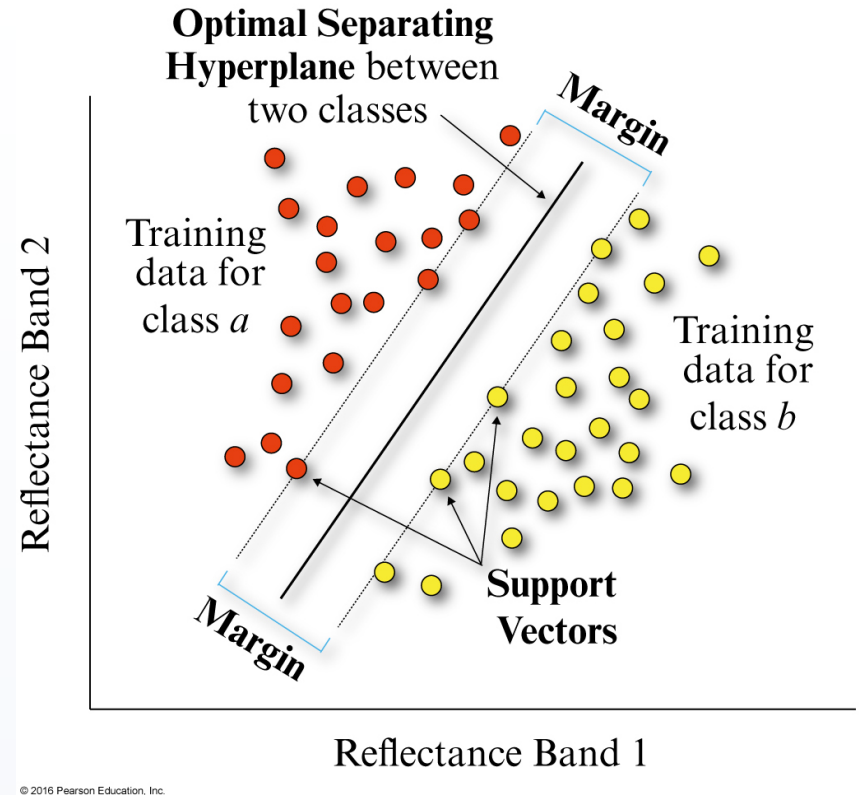
# Random Forest classifiers

- An ensemble of decision trees (get it?)
- Each tree classifies (votes) for an object
  - Final classification is the one with the most votes
- Classification using “wisdom of the crowd”



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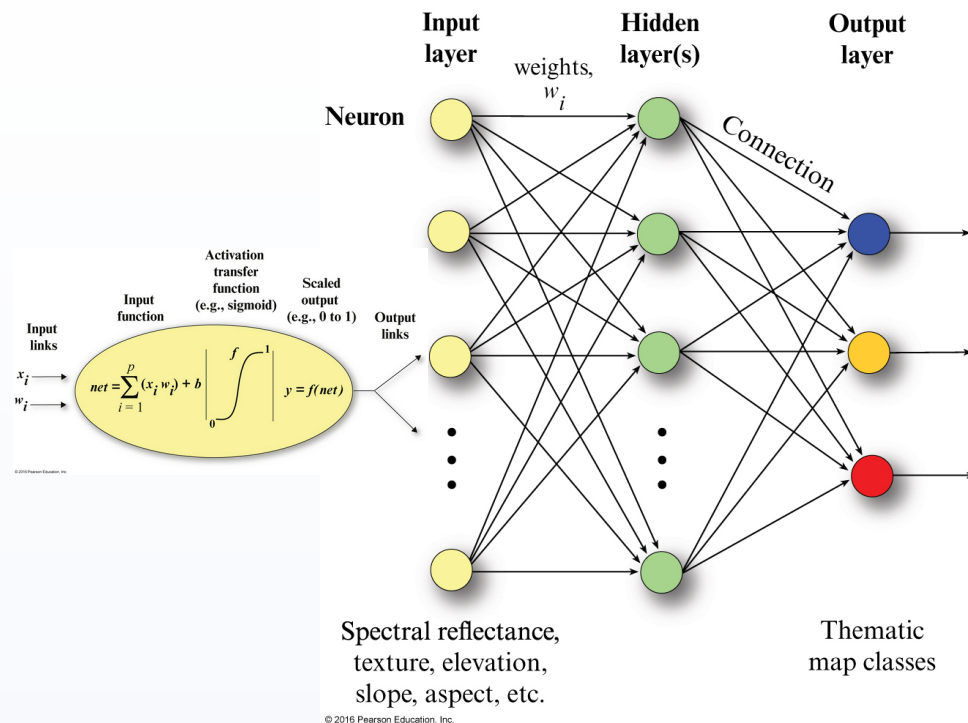
- Aim to find location of **decision boundaries** to separate classes
- Given 2 classes:
  - Find line (**hyperplane**) that leaves greatest **margin** between classes
  - Margin: distance between hyperplane, closest points (**support vectors**)
  - If not linearly separable, maximize margin, minimize misclassification
- Originally used for binary problems, can be adapted to multi-class



# Artificial Neural Networks (ANNs)

- Network of connected nodes – (artificial) **neurons**
- Connections have weight that is adjusted with learning
- Neuron:
  - Processes input signal (value) using a non-linear function (activation/transfer)
  - Transmits signal to other neurons
- Neurons are aggregated into **hidden layer(s)**

## Typical Artificial Neural Network Components



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- Machine Learning has a number of applications for remote sensing classification
- Different applications will be better-suited for certain algorithms/approaches
- Powerful method of classification/pattern identification, especially with large amounts of data
  - e.g., automated detection/mapping of features/objects

- Jensen – Chapter 10
- Pal, 2005 [[Int J Rem Sens](#)]
- Pal and Mather, 2005 [[Int J Rem Sens](#)]
- Maxwell et al., 2018 [[Int J Rem Sens](#)]
- Lary et al., 2016 [[Geosci Frontiers](#)]