Classification – Type 1 & 2 Errors

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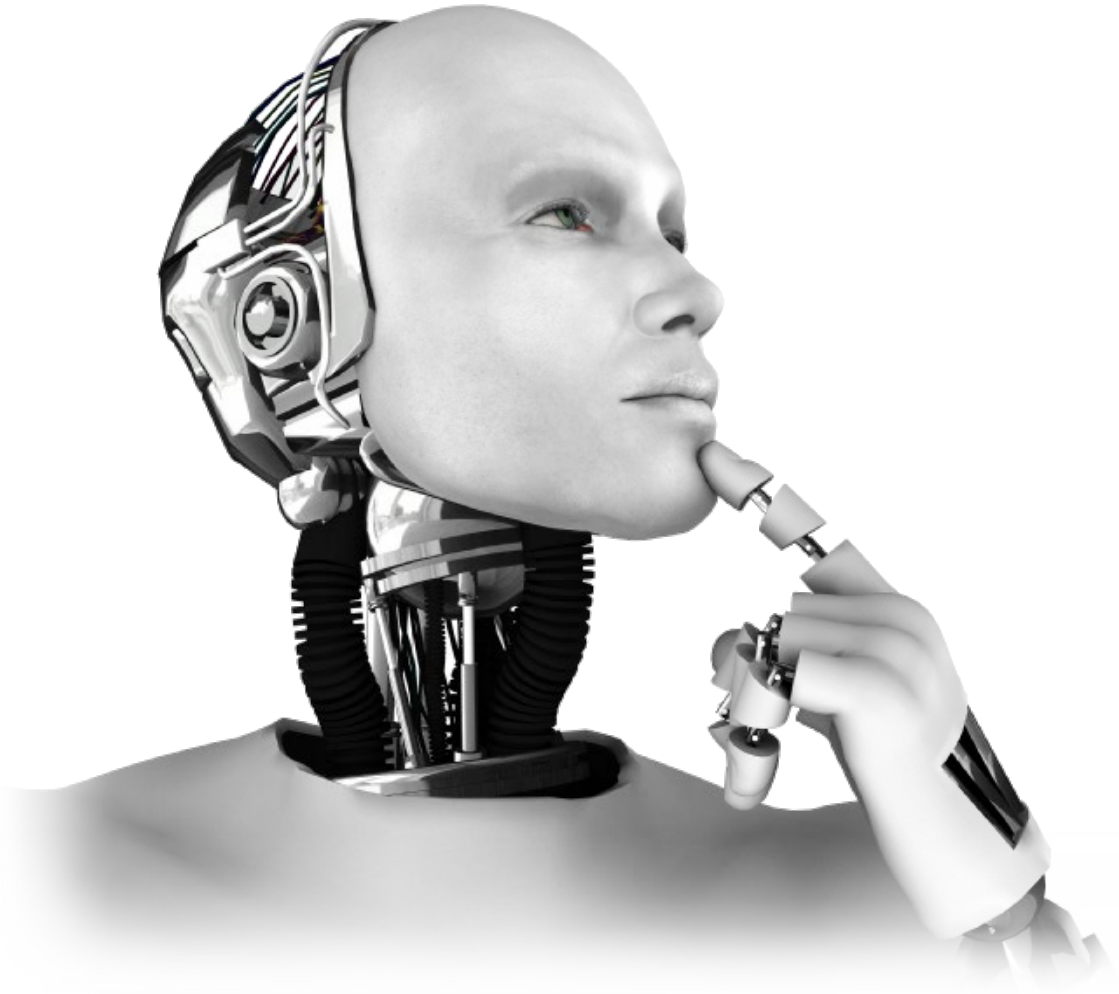
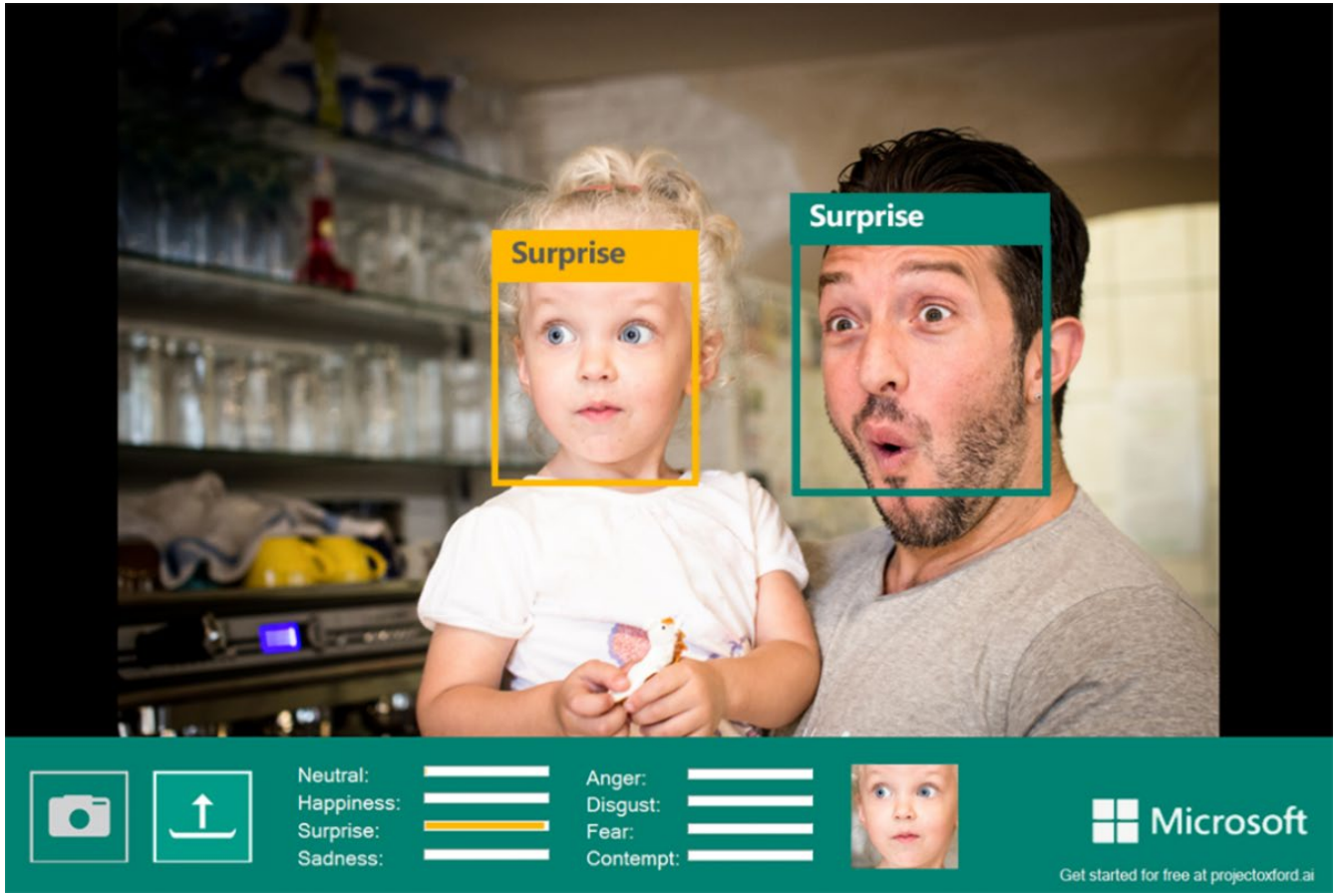
Artificial Intelligence

The intelligence exhibited by machines



Artificial Intelligence

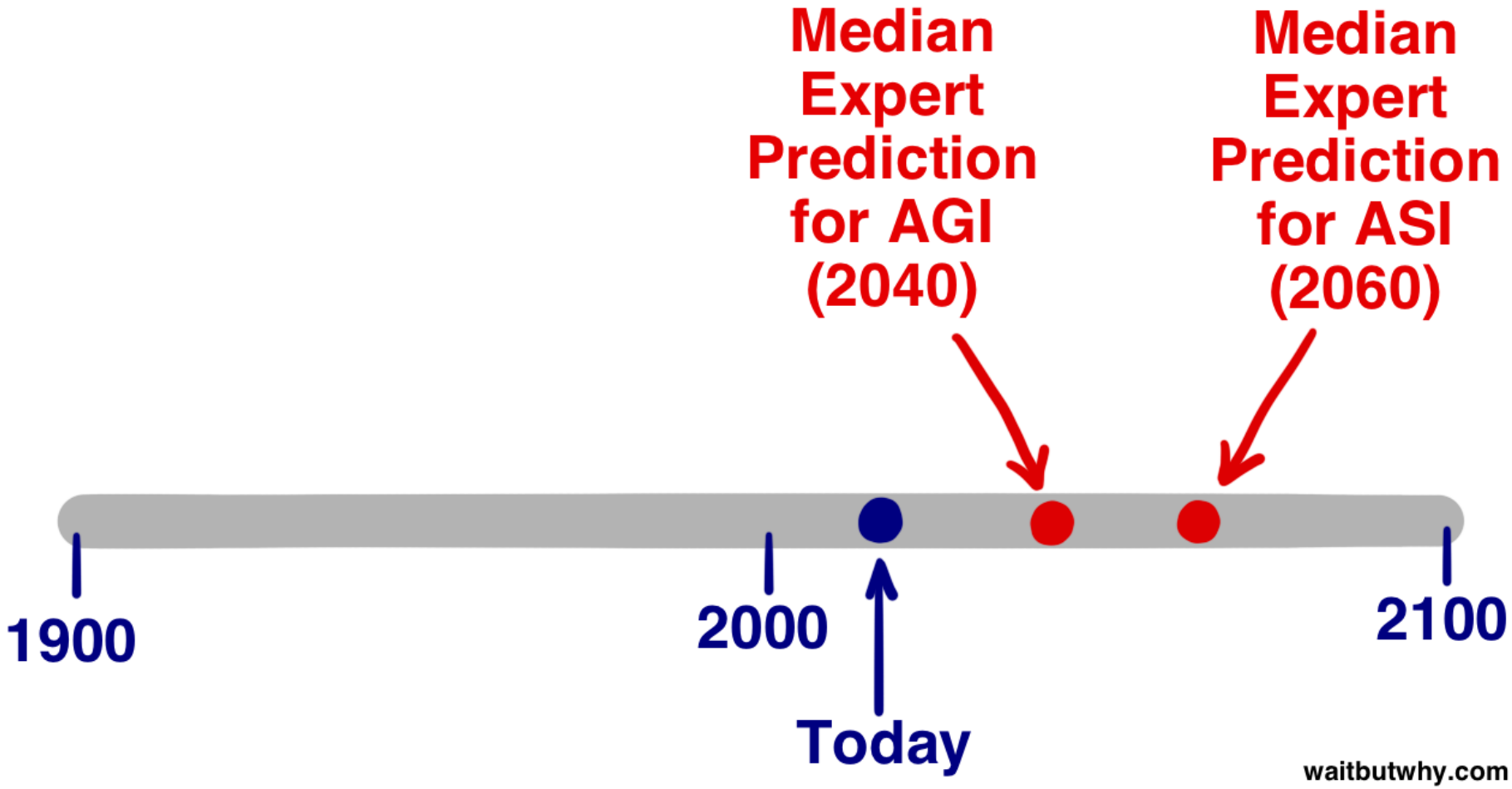
How to create computers and computer software that are capable of intelligent behavior



Artificial Intelligence - Types

- Artificial Narrow Intelligence (ANI)
  - Weak AI
  - Specializes in one area
  - Ex) AlphaGo, Siri, Spam mail filter, Translator, etc…
- Artificial General Intelligence (AGI)
  - Strong AI (Human level AI)
  - Be as smart as a human across the board
- Artificial Super Intelligence (ASI)
  - Be smarter than the best human brains in every field

Artificial Intelligence - Types



Machine Learning

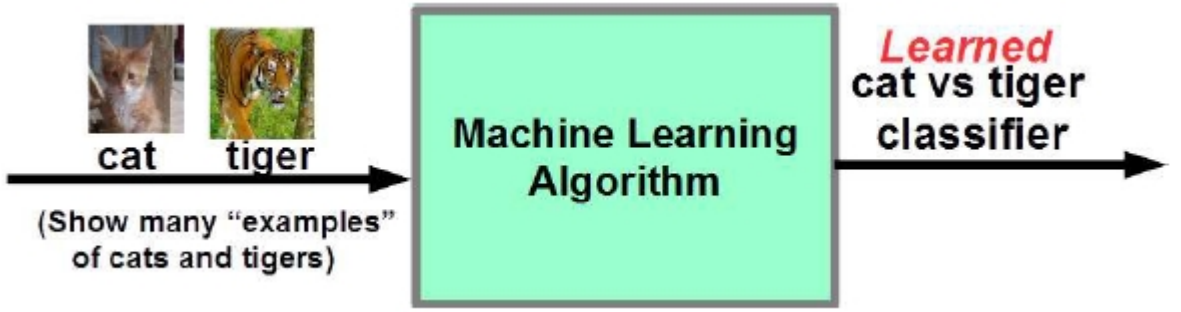
- Subfield of artificial intelligence
- Study of pattern recognition and computational learning theory
- Creating programs that can automatically learn rules from data

"Field of study that gives computers the ability
to learn without being explicitly programmed"
(Arthur Samuel, 1959)

Machine Learning

- Traditional: Write programs using hard-coded (fixed) rules

- Machine Learning: Learn rules by looking at some training data

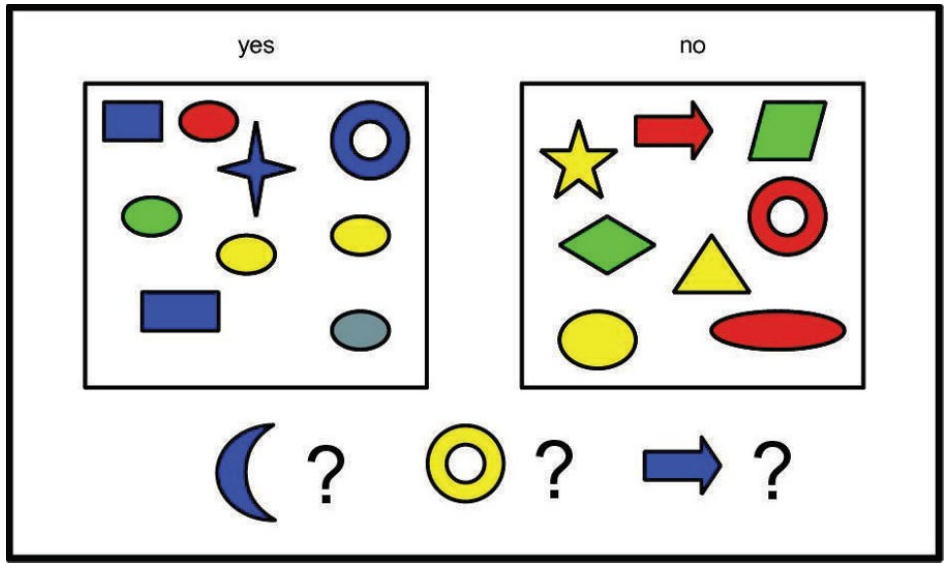


Machine Learning

- Supervised Learning
  - Predictive approach
  - To learn a mapping from inputs to outputs
  - Example) classification, regression
- Unsupervised Learning
  - Descriptive approach
  - To find interesting patterns in the data
  - Example) clustering, dimensionality reduction

Supervised Learning

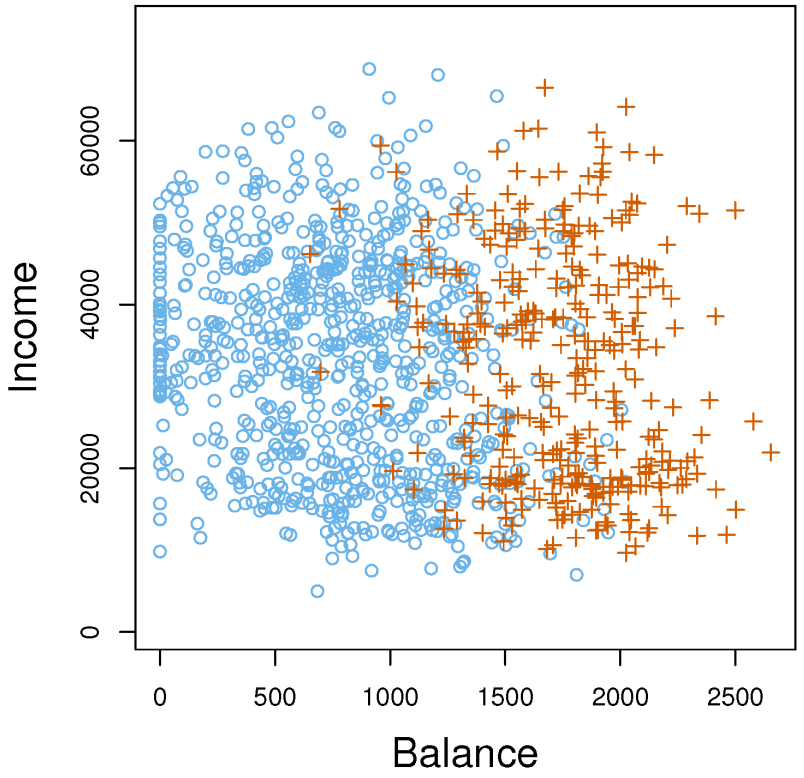
- Given: Training data as labeled instances $\{(x^{(1)}, y^{(1)}), \ldots, (x^{(N)}, y^{(N)})\}$
- Goal: Learn a rule $(f: x \rightarrow y)$ to predict outputs y for new inputs x
- Example)
  - Data: ((Blue, Square, 10), yes), . . . ((Red, Ellipse, 20.7), yes)
  - Task: For new inputs (Blue, Crescent, 10), (Yellow, Circle, 12), are they yes/no?

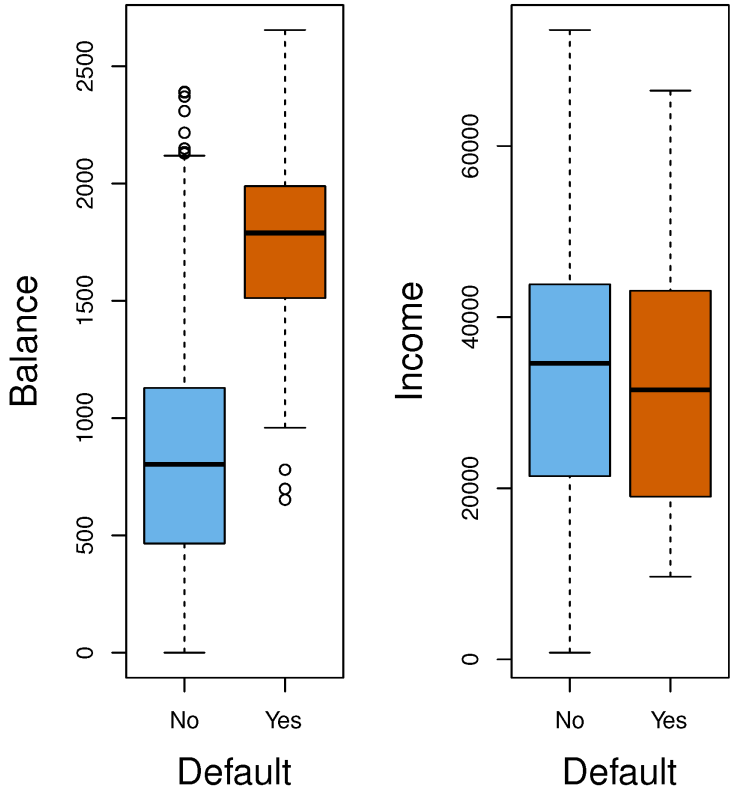


Color	Shape	Size	Label
Blue	Square	10	1
Red	Ellipse	2.4	1
Red	Ellipse	20.7	0
Blue	Crescent	10	?
Yellow	Circle	12	?

Problem

- Data: Credit card balance, annual income, default or not
  {(Balance, Income), Default?}
- Task: Predict whether a person will default on his/her credit card payment





Classification Performance

- Questions
  - Which model will be best?
  - How to measure the performance of classification model?
- Answer: Confusion matrix

		Predicted	
		Yes	No
Actual	Yes	True Positive (TP)	False Negative (FN)
	No	False Positive (FP)	True Negative (TN)

Classification Performance - Measurement

- Accuracy
  - Did the model get it right?
  - $(TP + TN)/ALL$
- Precision
  - How many selected items are relevant?
  - $TP/Prected\ "yes"$
- Recall
  - How many relevant items are selected?
  - $TP/Actual\ "yes"$
- F score
  - Combination of precision and recall
  - $2 * (Precision\ * Recall)/(Precision + Recall)$

		Predicted	
		Yes	No
Actual	Yes	True Positive (TP)	False Negative (FN)
	No	False Positive (FP)	True Negative (TN)

Classification Performance - Measurement

- Example) Predict whether a person will default, Logistic regression, 100 test data
- Accuracy
  - Did the model get it right?
  - $(TP + TN)/ALL$
- Precision
  - How many selected items are relevant?
  - $TP/Prected$ "yes"
- Recall
  - How many relevant items are selected?
  - $TP/Actual$ "yes"
- F score
  - Combination of precision and recall
  - $2 * (Precision\ * Recall)/(Precision + Recall)$

		Predicted	
		Yes	No
Actual	Yes	70	15
	No	10	5

Type 1 & 2 Error

- Type 1 error depends on False Positive
- Type 2 error depends on False Negative

		Predicted	
		Yes	No
Actual	Yes	True Positive (TP)	False Negative (FN)
	No	False Positive (FP)	True Negative (TN)