

CSE340, Winter 2020 Lecture Notes

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## Mobile Machine Learning

Smartphone data is intimate

- LeafSnap → identify leaf types with a picture

### Machine Learning

- 1 area of AI
- Can use example data as “experience”
- Makes predictions

#### Types of Learning

👁 *Supervised learning* (we have lots of examples of what should be predicted)

🔗 *Unsupervised learning* (e.g. clustering into groups and inferring what they are about)

👁🔗 Can combine these (semi-supervised)

🔄 Can learn over time or train up front

#### How might you recognize sleep?

- Sense noises, movement, possibly light sensing
- Predicts how much you sleep, quality of sleep, nightmare frequency...etc

#### Feature-based Learning

- How to program this? Write down some rules, implement them
- Figure out which *features* are needed

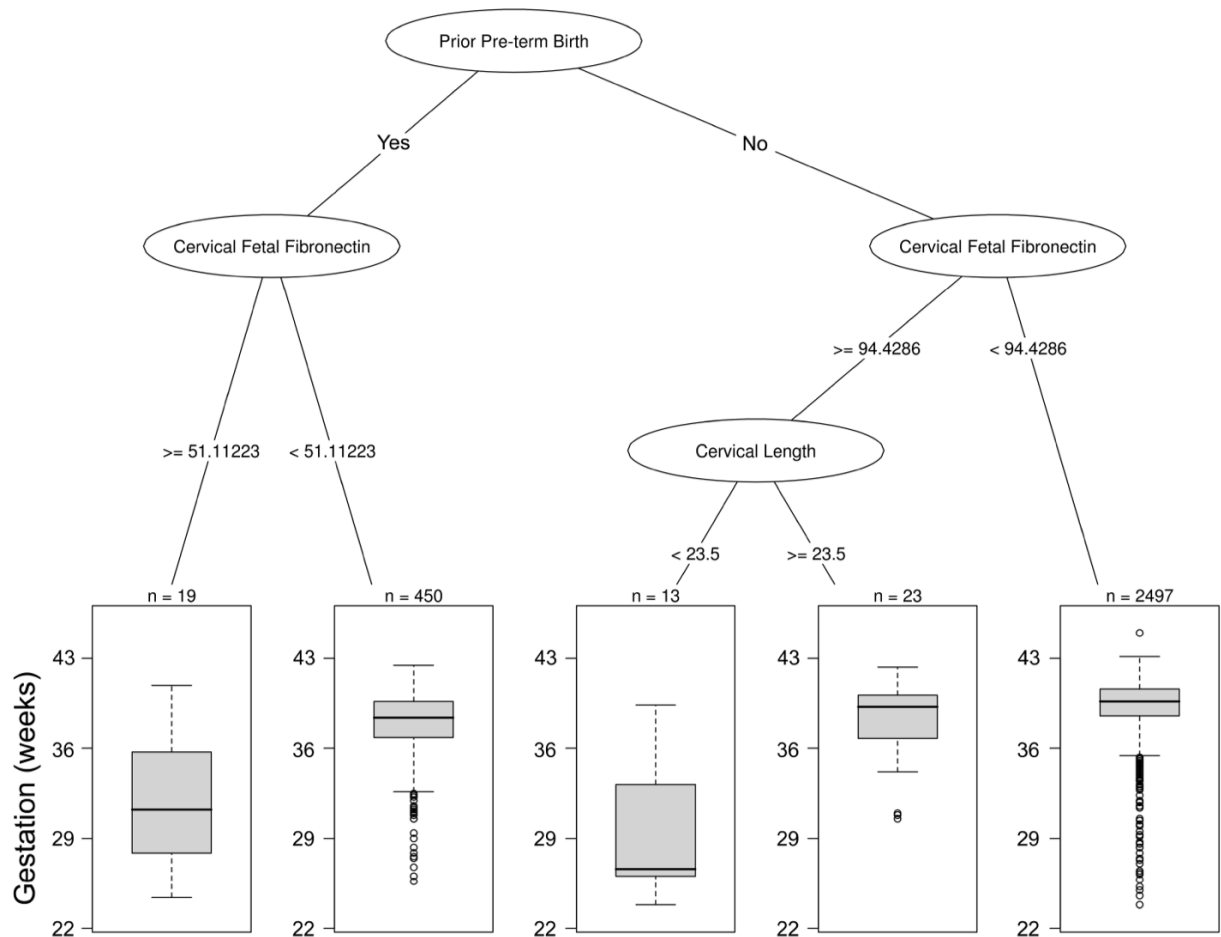
#### Using Linear Regression

- Predict continuous value based on inputs
  - House prices based on #rooms + #bathrooms
  - Predict income based on education level
- Minimal overall error

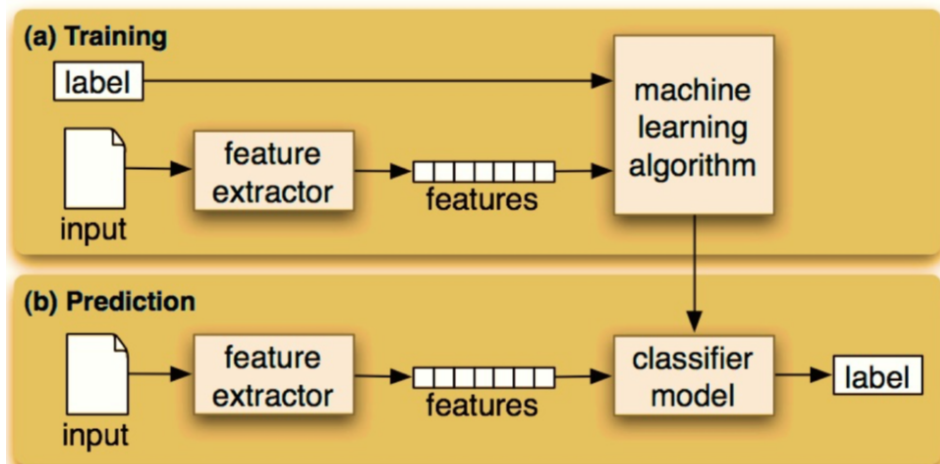
#### Classification

- Predicting from set of categories
  - Ex: {Spam, Ham}?
  - Lots of variants, can identify all objects in one class, Multi-label (it's both a hamburger and burrito)
- Naive Bayes, Neural Networks, Decision Trees

## Decision Tree



- Iteratively updates the tree as new information is gathered
- Bottom box and whisker plots represent actual range of data
- ML Algorithms definitely not covered in this class

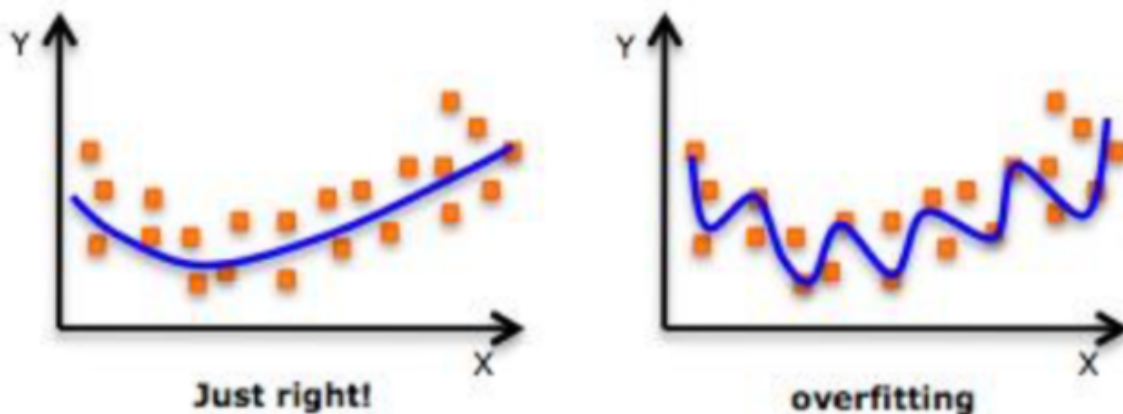


Assessing accuracy of ML models: confusion matrix (see below)

Prediction	
	Positive
Label Positive	True Positive (good)
Negative	False Positive (bad)
	Negative
Label Positive	False Negative (bad)
Negative	True Negative (good)

- **Accuracy** is  $(TP+TN)/(TP+FP+TN+FN)$
- Accuracy only gives part of the whole picture, need to analyze **precision**
  - Of the positive items, how many are right?
  - $TP/(TP+FP)$

Other Evaluation concerns regarding ML: *overfitting* your model



- A lot of people outside of computer science often *ascribe human behaviors to AI systems*
  - desires and intentions
  - Malicious goals (ex: medical insurance companies)
  - Significant societal challenges for privacy risks
    - Abuse partner stalking, parental over-monitoring
  - Which resume to best put out for recruiters? Will these algorithms further deepen the social divides of race, socio-economic status, and gender?
    - University Name
    - *Gender* of Name
    - Years of Experience

### Mixed Initiative best practices

- The AI should ask the user if they truly wish to do something
  - Automated cars
- Consider cost, benefit, uncertainty
  - Use dialog to resolve uncertainty, resolve recent interactions