

## Finance & CS

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## Banks

- Why do banks pay interest to you for your deposit?
- Banks also need to pay for staff, ATM machines, buildings...
- How do banks make money?

## Deposits vs Loans

- Banks make money by lending money
- The interest rates for loans are higher than those for deposits

## Consumer/Personal Loans

- Loans
  - Automobiles [car loans]
  - Houses [mortgages]
  - Credit cards
  - ...
- Which one has the highest interest rate?
- Why?

## Commercial/Business Loans

- Expand/start a company
  - Equipment
  - Supplies
  - Buildings
  - Staff
  - ...
- ...

## Credit Cards

<http://www.creditcards.com/credit-card-news/credit-card-industry-facts-personal-debt-statistics-1276.php>

- # of US cards in 2008/2009
  - $309 (V) + 211 (MC) + 54 (AE) + 57 (D) = \sim 631$  million
  - Population:  $\sim 300$  million [infants to ...]

## Credit Cards

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- # of US cards in 2008/2009
  - 309 (V) + 211 (MC) + 54 (AE) + 57 (D) = ~631 million
  - Population: ~300 million [infants to ...]
- # of US transactions in 2008
  - 9.2 (V) + 6.3 (MC) + 3.9 (AE) + 1.6 (D) = 21 billion
  - 58M per day
  - 666 per second (average, not peak)

## Credit Card Application

Problem 1

## Credit Card Application

- Decision (approve/deny) in seconds online
- Software
  - Humans create the knowledge for approval
  - Humans implement the knowledge
  - Programs make decisions

## How do humans create the knowledge?

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- Experience on previous good and bad customers
  - Find characteristics that can differentiate them
- But...

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- Experience on previous good and bad customers
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- But...
  - Millions of customers
  - Billions of transactions

## Credit Card Application

- Decision (approve/deny) in seconds online
- Software
  - Humans create the knowledge for approval
  - Humans implement the knowledge
  - Programs make decisions
- More intelligent software
  - Programs create the knowledge for approval
  - Programs implement the knowledge
  - Programs make decisions

## Problem Formulation

- Given (input)
  - Previous customers
    - Fields on the application form
    - Good or bad customer
- Find (output)
  - Knowledge that can differentiate good from bad customers

## Problem Formulation

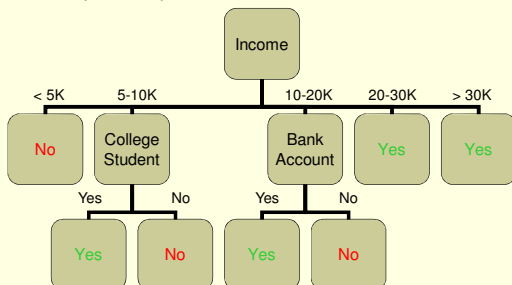
- Given (input)
  - Previous customers -> **examples**
    - Fields on the application form -> **attributes/features**
    - Good or bad customer -> **class**
- Find (output)
  - Knowledge that can differentiate **classes**

## Input

Attr 1 (income)	Attr 2 (age)	Attr 3 (occupation)	...	Attr m	Class (good)
					Y
					Y
					N
					N

## How to represent knowledge?

- One possibility is Decision Tree



## Problem Formulation

- Given (input)
  - Previous customers -> **examples**
    - Fields on the application form -> **attributes/features**
    - Good or bad customer -> **class**
- Find (output)
  - **Decision tree** that can differentiate **classes**
- Simplification
  - All attributes are **discrete, no missing values**

## Algorithm overview

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- Use examples to choose the “best” attribute to be the root node
  - Assign examples to each branch
  - For each branch
    - Use examples for the branch to build a subtree (recursively)

## Stopping Criteria (reaching the leaves)

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1. Running out of attributes
  - Attributes used in the ancestors are not reused
2. Running out of examples
  - Each branch has a subset of the examples
3. No confusion in the final decision in the examples
  - All examples in the branch belong to the same class

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- Credit card transaction approval (fraud detection)

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- Home mortgage application
- Credit card transaction approval (fraud detection)
- Trading (buying/selling) stocks