Machine Learning (Most of AI)

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What we have learned so far ?

- Big Picture

- Overview of Data management

- Statistics/probability – mean/median/mode, CLT, normal,poisson,exponential,uniform distributions

- Population/Sample - same distribution sampling,sampling strategies.

- Confidence intervals,hypothesis testing – p-value, z-test, t-test,anova,chi-square test

- Linear regression, logistic regressions.

Let us think through this

- Probability vs statistics – difference ?

Probability

- Probability

-
  Model/pattern of data generation ---> probabilities of outcome ?

- Parameters related to the above.. Different distributions, etc.

  eg., if we have exponential distribution for a light bulb, with average life time of 2 years, what can you say about the two outcomes (bulb fail, bulb survives) after 3 years ?

Statistics

- Statistics

  Given a bunch of data or outcomes, what model is it ? What are the parameters of the model ?

- Infer the parameters related to the above.. Infer the correctness/confidence in a hypothesis..

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  Eg., you collect data about students coming into the class from 9 am till 10 am for a class that starts at 9:30 am ! (what distribution is it ?)

  Other examples ?

Machine Learning

- A computer program is said to learn from experience E with respect to some class of tasks T, and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E."
  - Eg., hand written number recognition
    - T – recognize and classify the numbers
    - P - Correctly classify them
    - E – training set of hand written numbers and their classification.

Machine Learning(ctd.)

- Other examples
  - Regression – real estate prices, stock market values
  - Classification – images, categorization based on features, etc.
  - Recommender systems – shopping cart, movies
  - Anamoly detection – credit card fraud etc.
  - Machine translation – one language to other.

Machine Learning - Performance

- Loss functions
- Accuracy of predictions or error rate.
- Objective functions – specific to the problem
  - Mean squared error (regression)
  - Maximize the rewards
  - Minimize the total distance (clustering)

Machine Learning –Experience

- Process of learning
  - Supervised learning – teacher
    - Maps from a vector to a label value
    - It could be classification or regression
  - Unsupervised
    - Clustering – discover groups of data
    - Density estimation – what kind of distribution it could be ?
  - Reinforcement Learning
    - A set (sequence) of actions to take to maximize a reward. Eg., a game where next move has a set of alternatives and program chooses the best alternative.
    - Robot doing an action effectively.
  - Active learning – by questions, transfer learning – apply what you learnt in A to B.

Supervised Learning

- Features
  - Feature vector (x1, x2, .. xn)
  - Could be very large.
  - Eg., pixels in an image.
  - Eg., blood report, xray images
  - Eg., Monitored system data.
  - Eg., house size, location, features etc.
- Labels or target
  - Image is a number 1 .. 9 – classify
  - Cancer onset or not
  - System is failing or healthy
  - House price.

Supervised Learning (ctd.)

- A function f(features) ---> target
- The function f could be a FAMILY of functions.
- The function will have many parameters depending on the model:
  - Linear model for a feature vector of size n will have n parameters.
  - Quadratic model will have … how many ?
  - "n" the degree polynomial will have many parameters ?

- TRAINING SET
- TEST SET
- VALIDATION SET (may or may not be there).

Supervised Learning (ctd.)

- Performance
  - Sum of squares of the difference between predicted from actual.
  - Minimize the objective function (calculus technique)

Thank You !

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