Artificial Intelligence

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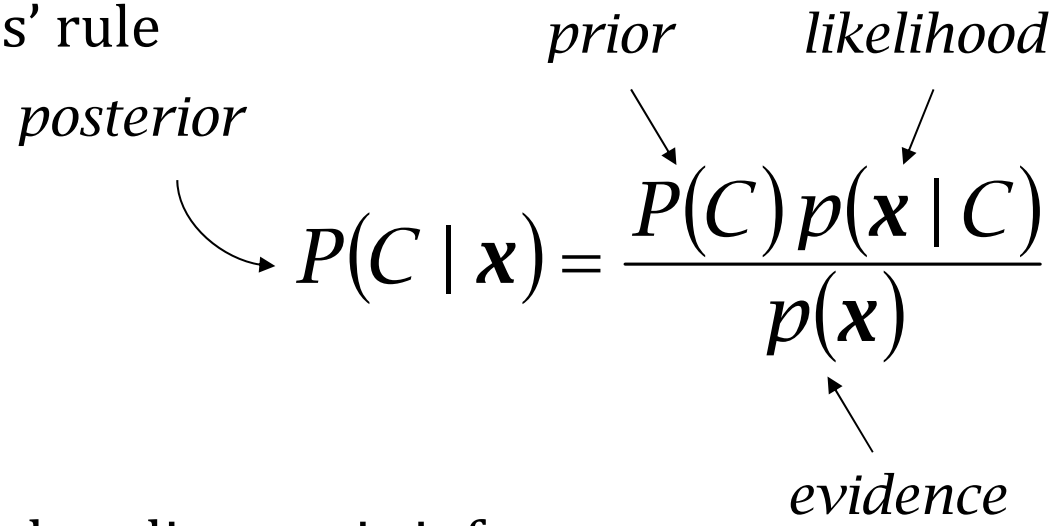
Learning Outcomes Bayesian Networks

- Bayesian theorem

$$P(A|B) = \frac{P(B|A)\,P(A)}{P(B)}.$$

- Bayes' rule

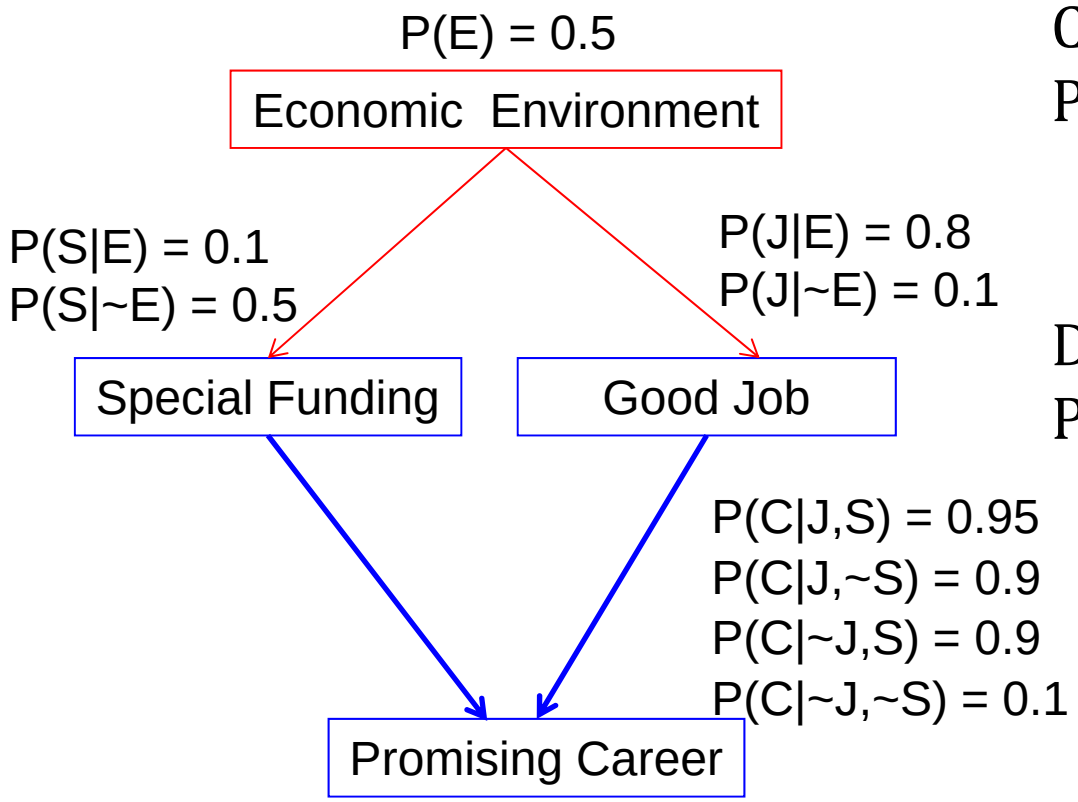


- Causal vs diagnostic inference

Problem

- The probability of good economic condition is 50%
- When the economic condition is good
  - 80% students can get a good job
  - Otherwise, 10% can get a good job
- When the economic condition is good
  - Government has 10% probability to set special funding for young person to startup
  - Otherwise 50% probability to set special funding for young person to startup
- What is the probability of promising path when the economic environment is good
  - What is the probability of the economic environment is good when we observe the promising career path

Bayesian Networks



Causal inference

$P(C|E) = 0.76$

Diagnostic inference

$P(E|C) = 0.58$

Course Presentation

- 10 minutes presentation
  - Brief introduction of the movie related with artificial intelligence
  - Brief introduction of artificial intelligence concepts, techniques, or/and systems appearing in the movie
  - Why do you choose this movie
  - What is your comment to the movie
  - What is your comment to the artificial intelligence concepts, techniques, or/and systems appearing in the movie
- 100 points and 10% for the final grading
  - 20 points: understanding of the movie
  - 20 points: understanding of the technology
  - 20 points: comment to the movie
  - 20 points: comment to the technology
  - 20 points: presentation organization

Before Presentation and After Presentation

- Before presentation
  - Check if the presentation slides and demos work well on the computer in Y410
- Presentation date
  - Oct. 27 2015 at 15: 30
  - The confirmed presentation order is announced on Oct. 20
- After the presentation
  - Send the slides to TA csstwu@comp.polyu.edu.hk for the record

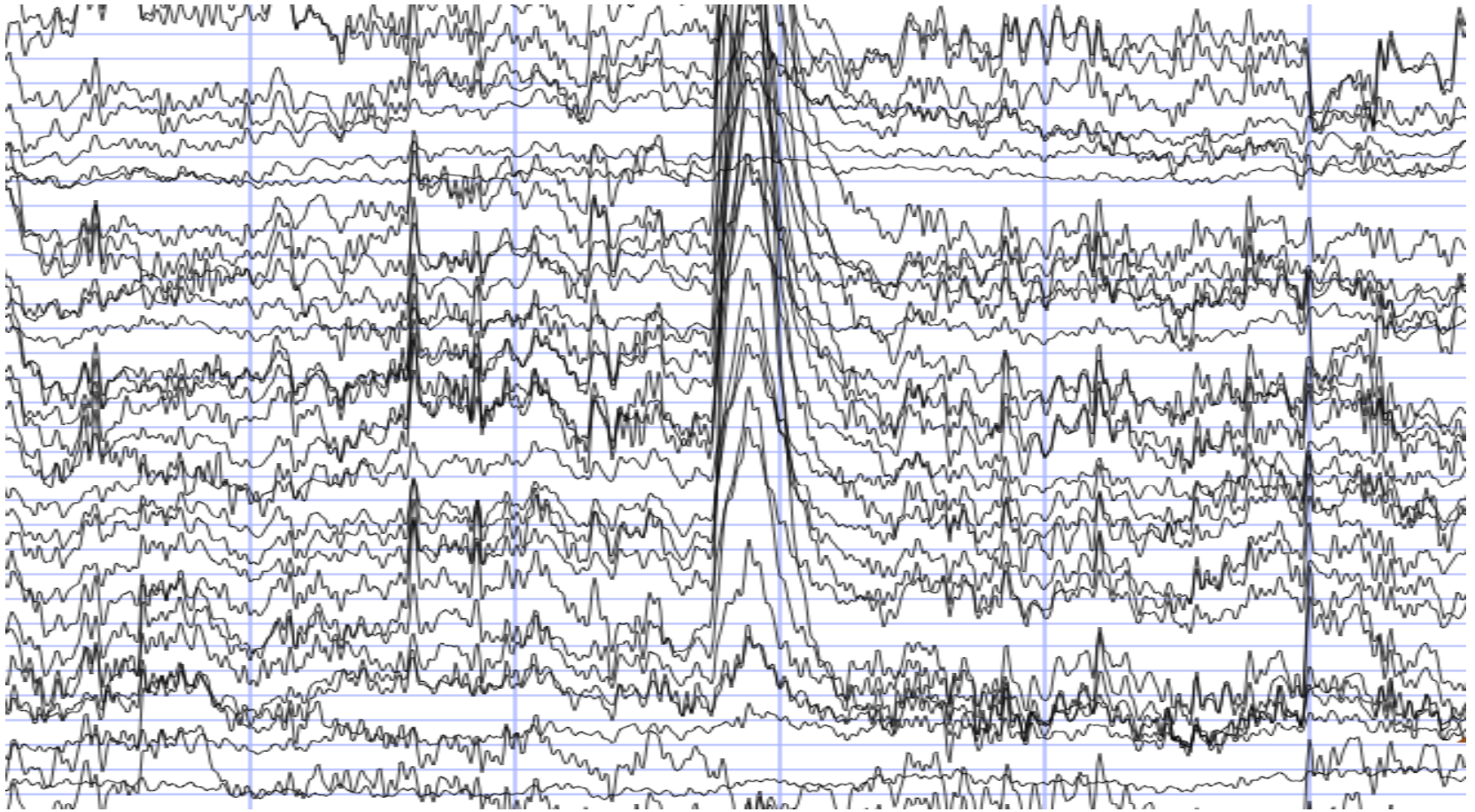
Presentation Order

- Leung Ka Him and Yan Ka Man;
- Tung Cheung Leong, Fung Hoi Ki, WANG Jianxun and Geng Xu;
- Lai Ka Tung, Chan Yin Kwong, Kung Wing Chun and Wan Tsz Kin;
- Lam chun kit, Chau ka wa and Lin ho ching janus;
- Lok Kwong Wai, Lu Cheuk Ting and Siu Man Chun Jackson;
- FONG Ho Yin, LEUNG Chun Yin and LIU King Hei;
- Lam Yan To, Kam Wai Man, Ko Wing Lam and Tsang Chi Hong;
- Lai Ka Tung, Chan Yin Kwong, Kung Wing Chun, Wan Tsz Kin

Course Project

- What you have seen?
  - Brain wave classification

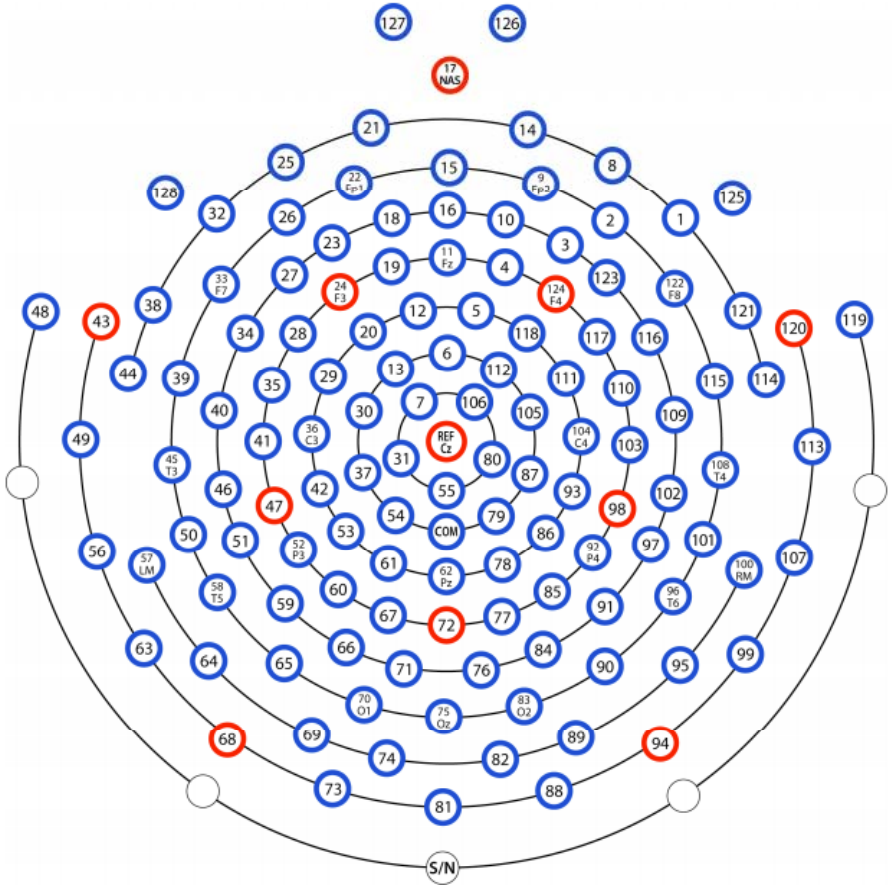
Brain Wave Collected by EEG



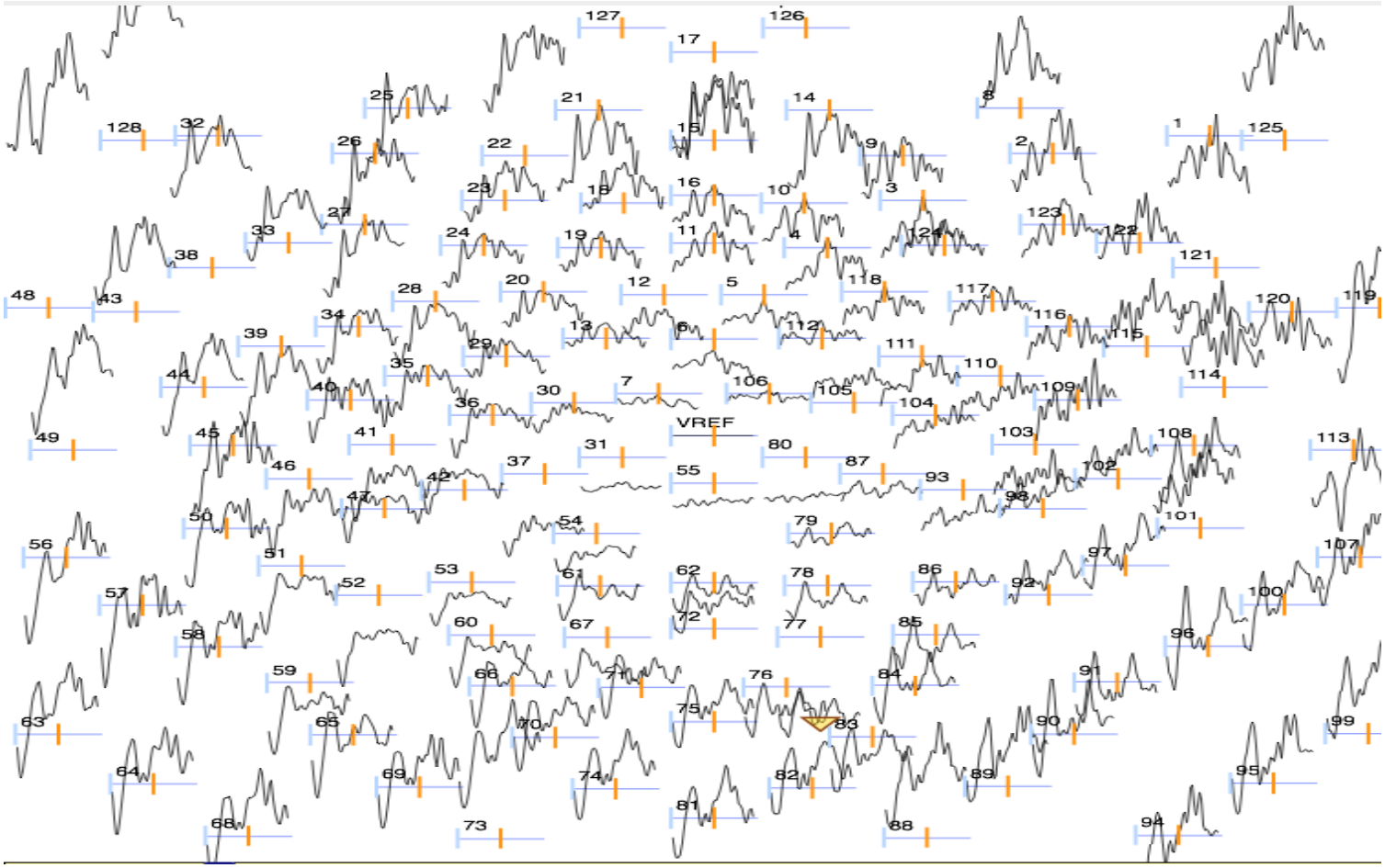
Course Project Setting

- Brain wave collection
  - You will attend a 8-minute experiment to watch 60 face images and 60 natural view images
  - The brain wave will be collected by EEG device
- Intelligent agent training
  - You will be given your own brain wave data
  - 30 for watching the face images and 30 for watching natural view images
- What you should submit
  - A intelligent agent, which could be used to classify new data
  - Input: data matrix
  - Output: data label

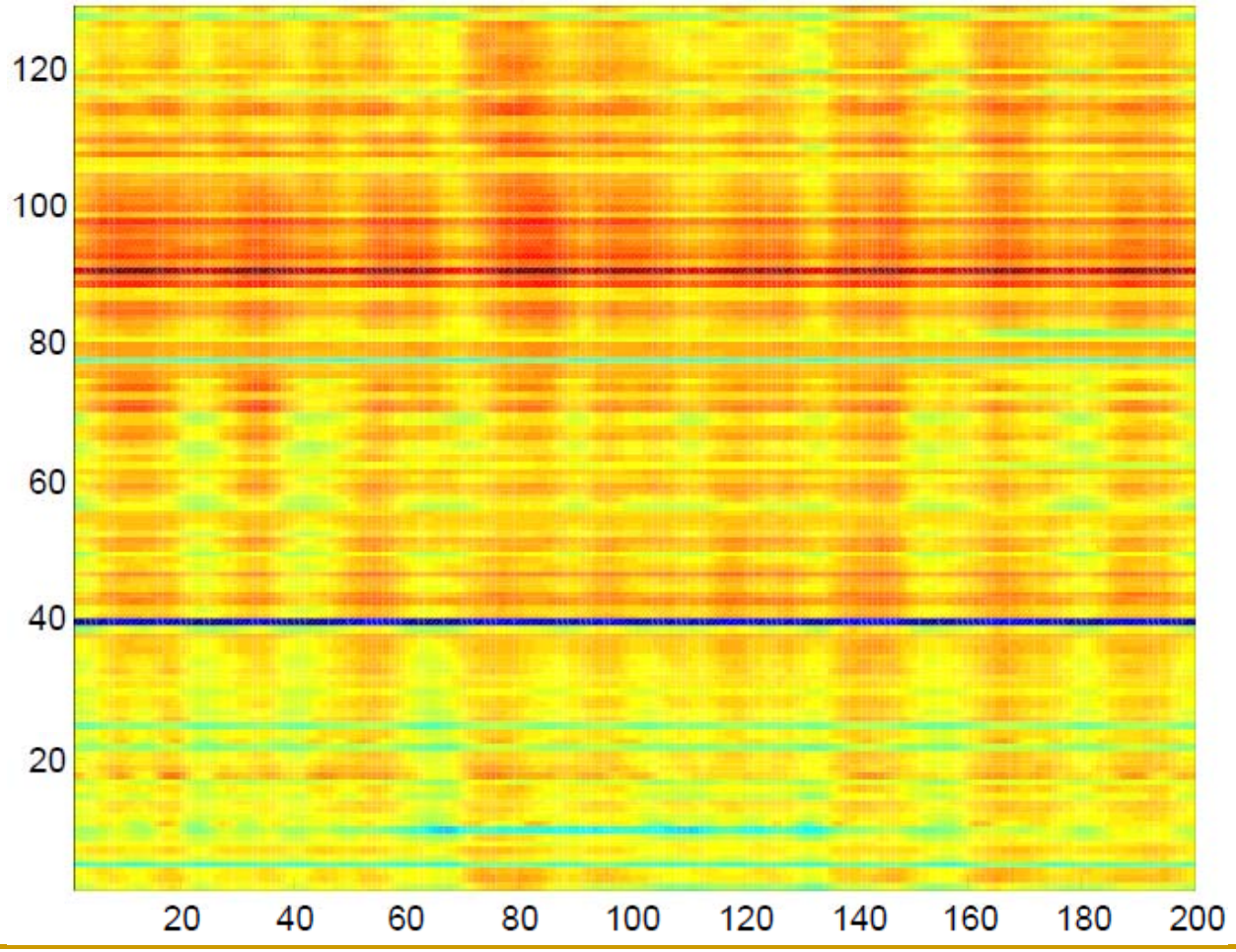
Data Collection



Original Signal



Input Data



Course Project Grading

- 100 points and 15% for the final grading
- 40 points is the performance of the test data of your own brain wave
  - 40 points for the accuracy
    - The group with highest accuracy will get the full mark
  - 10 points for the efficiency
    - The running time for each data is equal to or shorter than 10 seconds
- 50 points is the performance of the test data of others brain wave
  - 40 points for the accuracy
    - The group with highest accuracy will get the full mark
  - 10 points for the efficiency
    - The running time for each data is equal to or shorter than 10 seconds
- 10 points is for the one page readme

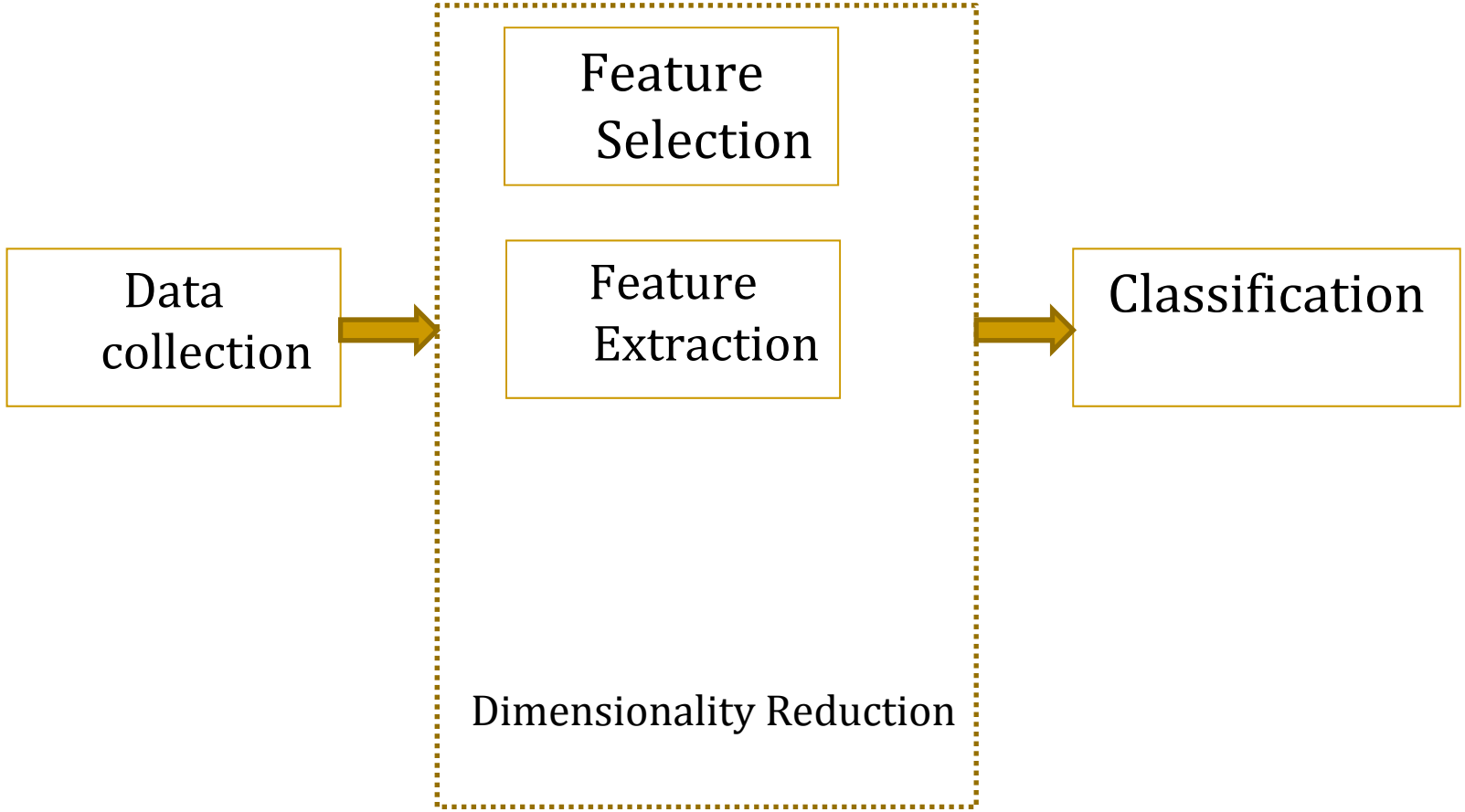
Course Project Summary

- 2 points for the instruction of software usage
  - Instruction of how to run the intelligent agent
- 2 points for the technique description
  - Description of the techniques used in the project
- 2 points for the feasibility of the techniques
  - Why you select this techniques
- 2 points for the parameter setting
  - How many parameters could be adjusted to achieve the better performance
- 2 points for the performance evaluation
  - Could you find the reason of good performance and failed cases

Important Date

- Deadline of the course project
  - Friday Nov. 27 2015 23:59
  - 30% deduction for one day delay
  - Source code and one page summary
  - Submit by blackboard
- Data collection
  - Tuesday Oct. 27 2015 to Thursday Nov. 26
  - PQ603
  - Make appointment with TA by email
- Classification techniques
  - Be discussed in the Lectures in Nov.

Intelligent Agent for Data Classification



Dimensionality Reduction

- Dimensionality reduction
  - Generate a lower dimensional equivalence to the original high-dimensional feature space for the given target
- Mathematical definition
  - Given the *D*-dimensional data point

$$\mathbf{x} = (x_1, x_{2,} \cdots, x_D)^T$$

  - Find a compact representation

$$\mathbf{y} = (y_1, y_2, \cdots, y_k)^T \qquad k \le D$$

  - Construct the transformation function to captured essentials in the original

$$\Phi : \mathbf{x} \to \mathbf{y}$$

$$\to [32\ 79\ \ 54\ \ \ldots\ \ldots\ ]^T$$

Feature Selection and Feature Extraction

- Classification based on the characters of the compact representation

$$y = (y_1, y_2, \cdots\cdots y_k)^T$$

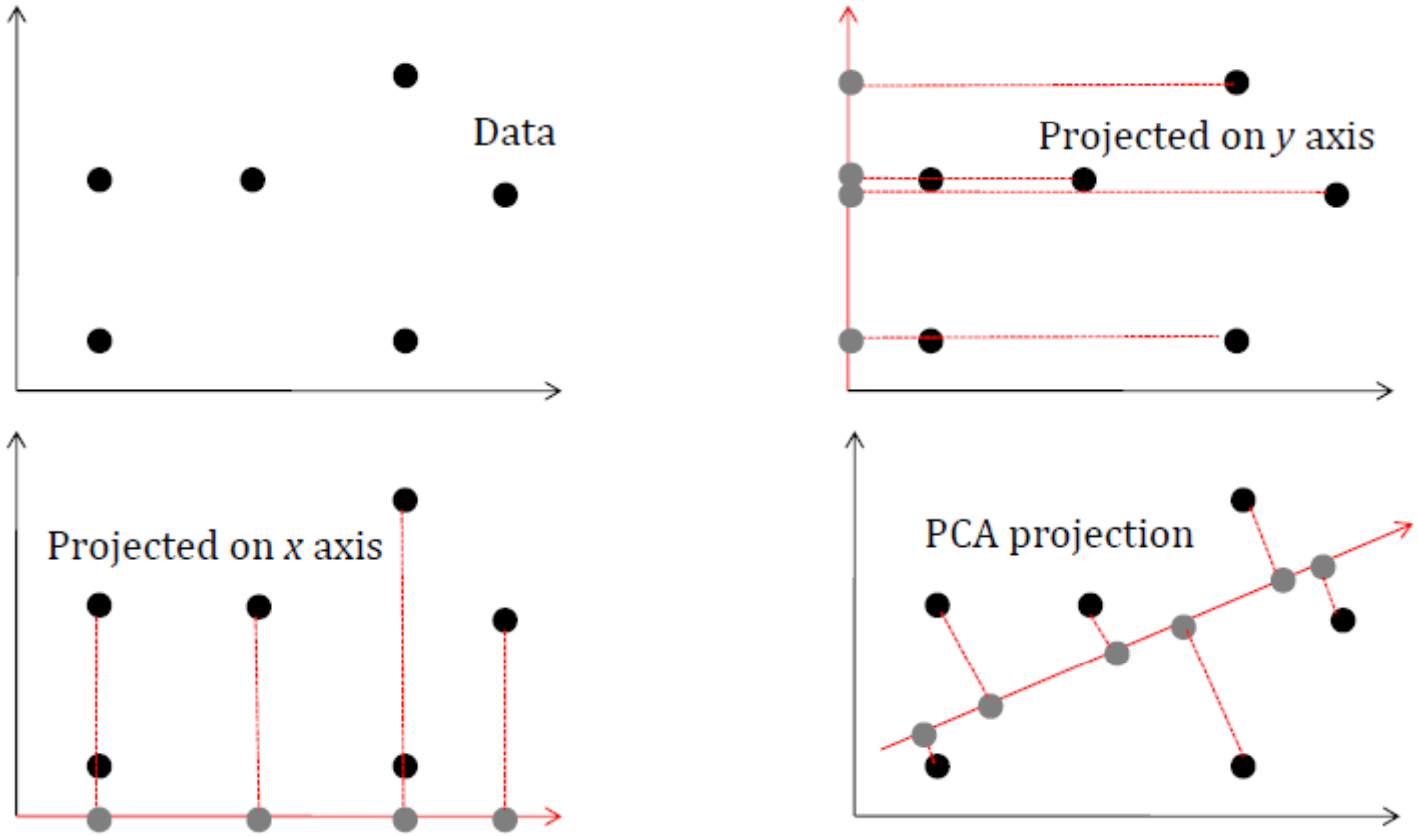
- Feature selection
  - Selects the components of the compact representation from the original feature space directly

$$y_i \in X \qquad 1 \le i \le k$$

- Feature extraction
  - Uses transformation function to generate the components of the compact representation from the original feature space

$$y_i = \psi(X) \qquad 1 \le i \le k$$

Principle Components Analysis



Genetic Algorithms

- A successor state is generated by combining two parent states
  - Start with *k* randomly generated states (population)
  - A state is represented as a string over a finite alphabet (often a string of 0s and 1s)
  - Evaluation function (fitness function). Higher values for better states.
- Produce the next generation of states by selection, crossover, and mutation
  - When two parent states are quite different, the crossover operation can produce a state that is a long way from either parent state.
  - Crossover helps if substrings are meaningful components.
  - Each location is subject to random mutation with a small independent probability.