Cross-media Data Retrieval

An application of machine learning techniques

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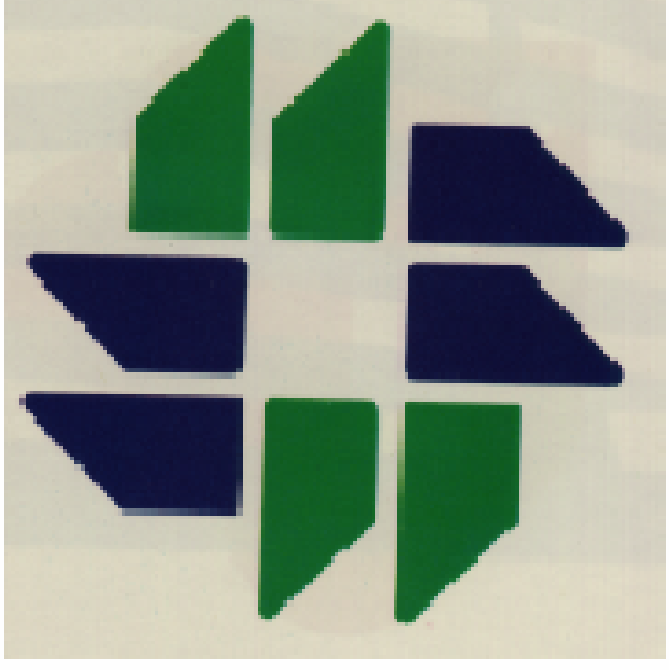
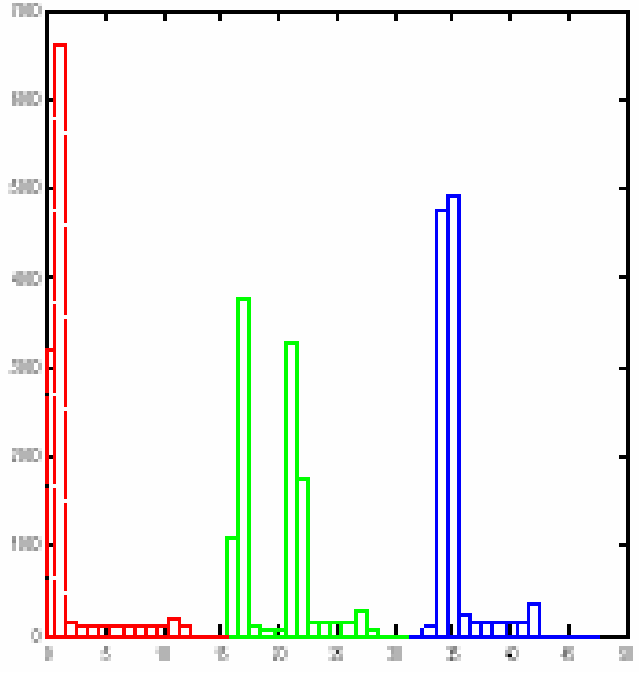
Outline

- **Motivation**
- **Problem**
- **Main Issue**
- **Basic Idea**
- **Summary**

Low-level Features

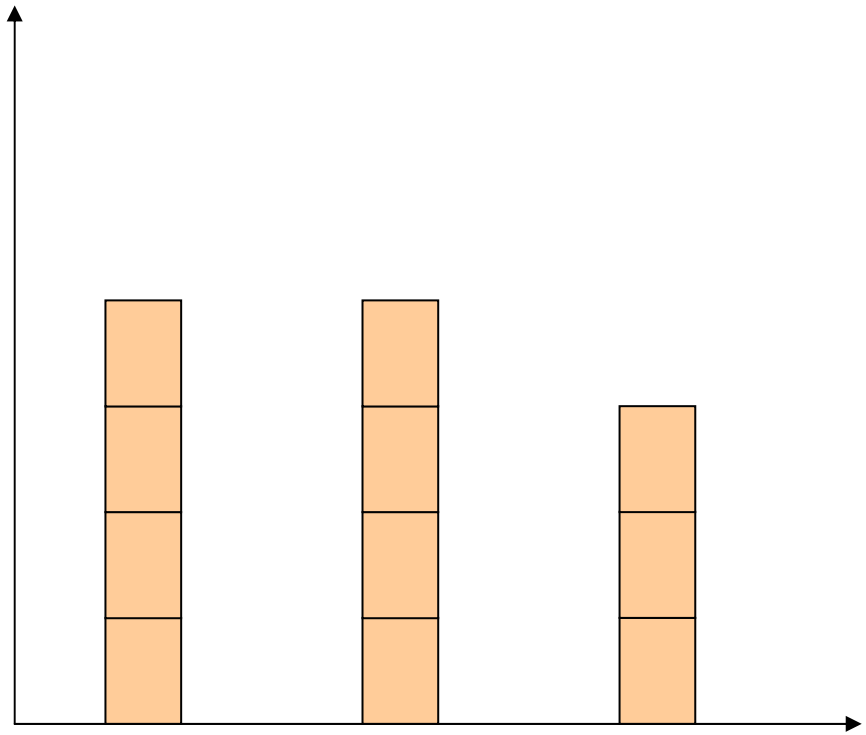
- **A multimedia object can be represented by the low-level features**
  - Example: image features [Jain and Vailaya, 1996]





Low-level Features

– Example: document features



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HIGHER EDUCATION REFORMS WILL PROTECT STUDENTS AND GRADUATES AND GIVE INVESTMENT AND FREEDOM TO UNIVERSITIES - CLARKE

08 January 2004

Education and Skills Secretary Charles Clarke today published reforms to higher education that will protect the poorest students and graduates, help parents of students, and give universities the investment and freedom they need to compete with the best in the world.

Introducing the Higher Education Bill to Parliament, Mr Clarke said that the reforms mean that from 2006, 30% of the poorest full time students will be guaranteed at least £3000 in financial support per year, including bursaries where universities are charging the highest fees.

黃蓉緩步上前，柔聲道：「過兒，郭伯伯全是為你好，你可要明白。」楊過聽到她溫柔的言語，心中一動，也放低了聲音道：「郭伯伯

這個規矩，楊過並不像小龍女那般一無所知，但他就是不服氣，為甚麼只因為姑姑教過他武功，便不能做他妻子？為甚麼他與姑姑絕

這番話當真是語驚四座，駭人聽聞。當時宋人拘泥禮法，那裏聽見過這般肆無忌憚的叛逆之倫？郭靖一生最是敬重師父，只聽得氣向上

小龍女吃了一驚，伸手便格。郭靖武功遠勝於她，此時盛怒之下，更是出盡全力，一帶一揮，將小龍女拋出丈餘，接著手掌一探，抓住

楊過給他一把抓住，全身勁力全失，心中卻絲毫不懼，朝聲說道：「姑姑全心全意的愛我，我對她也是這般。郭伯伯，你要殺我便下手

廳上群雄聽了，心中都是一凜，覺得他的話實在也有幾分道理，若是他師徒倆一句話也不說，在甚麼世外桃源，或是窮鄉荒島之中結成

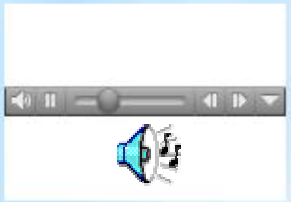
郭靖舉起手掌，淒然道：「過兒，我心裏好疼，你明白麼？我寧可你死了，也不願你做壞事，你明白麼？」說到後來，語音中已含哽咽

楊過聽他如此說，知道自己若不改口，郭伯伯便要一掌將自己擊死。他有時雖然狡計百出，但此刻卻又倔強無比，朗聲道：「我知道自

郭靖左掌高舉，這一掌若是擊在楊過天靈蓋上，他那裏還有性命？群雄凝息無聲，數百道目光都望他著手掌。

郭靖左掌在空際停留片時，又向楊過瞧了一眼，但見他咬緊口唇，雙眉緊蹙，宛似他父親楊康當年的模樣，心中一陣酸痛，長嘆一聲，

小龍女招手道：「過兒，這些人橫蠻得緊，咱們走罷。」她可絲毫不知適才楊過生死之際間不容髮。楊過心想「橫蠻」二字的形容，卻



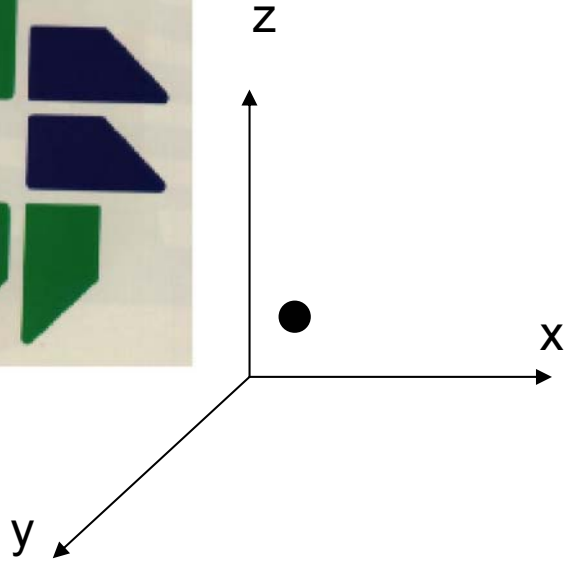
相似度：95%

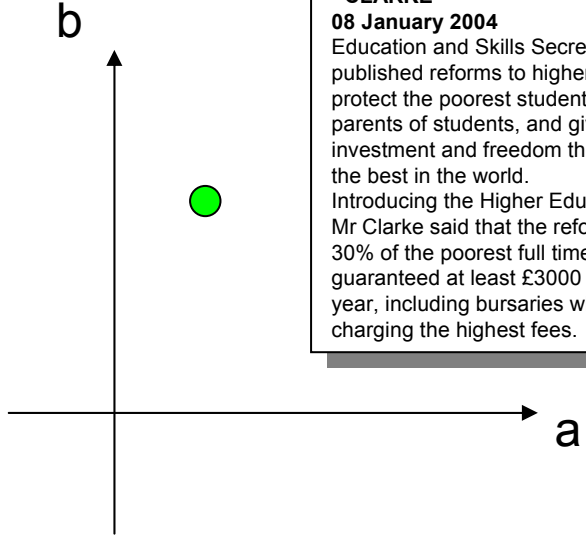
Problem

- **Given a query in one medium, find the answers in another media, which have the most similar semantics as the query.**
  - Main Issues
    1. It is hard to compute the distance between two objects represented by different low-level features.
    2. Two objects having the same semantic may have very different low-level feature values.
    3. It is hard for the users to specify what they want.

Main Issue (1)

- **Low-level features in different media can be irrelevant.**
- **It is hard to compute the distance between two objects represented by different low-level features.**





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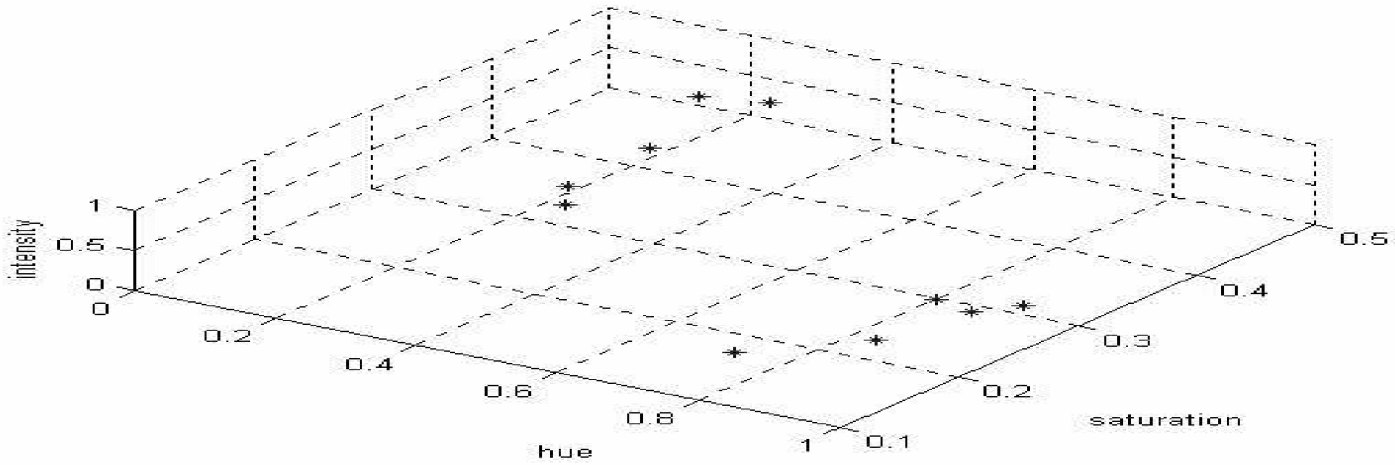
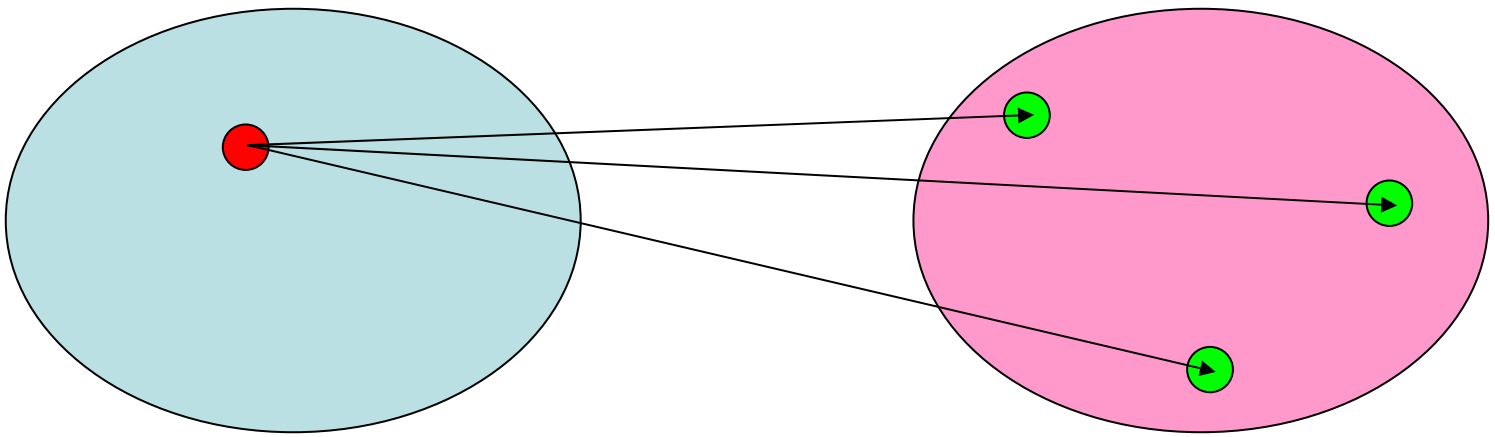
Main Issue (2)

- **Two objects having the same semantic may have very different low-level feature values.** **[Kim and Chung, 2003]**



Basic idea (1)

- **Transform the objects from different media into the same feature space**
  - Space transformation
  - One-to-Many mapping between low-level feature spaces does not exist



快樂：0.62

沉痛悲傷：0

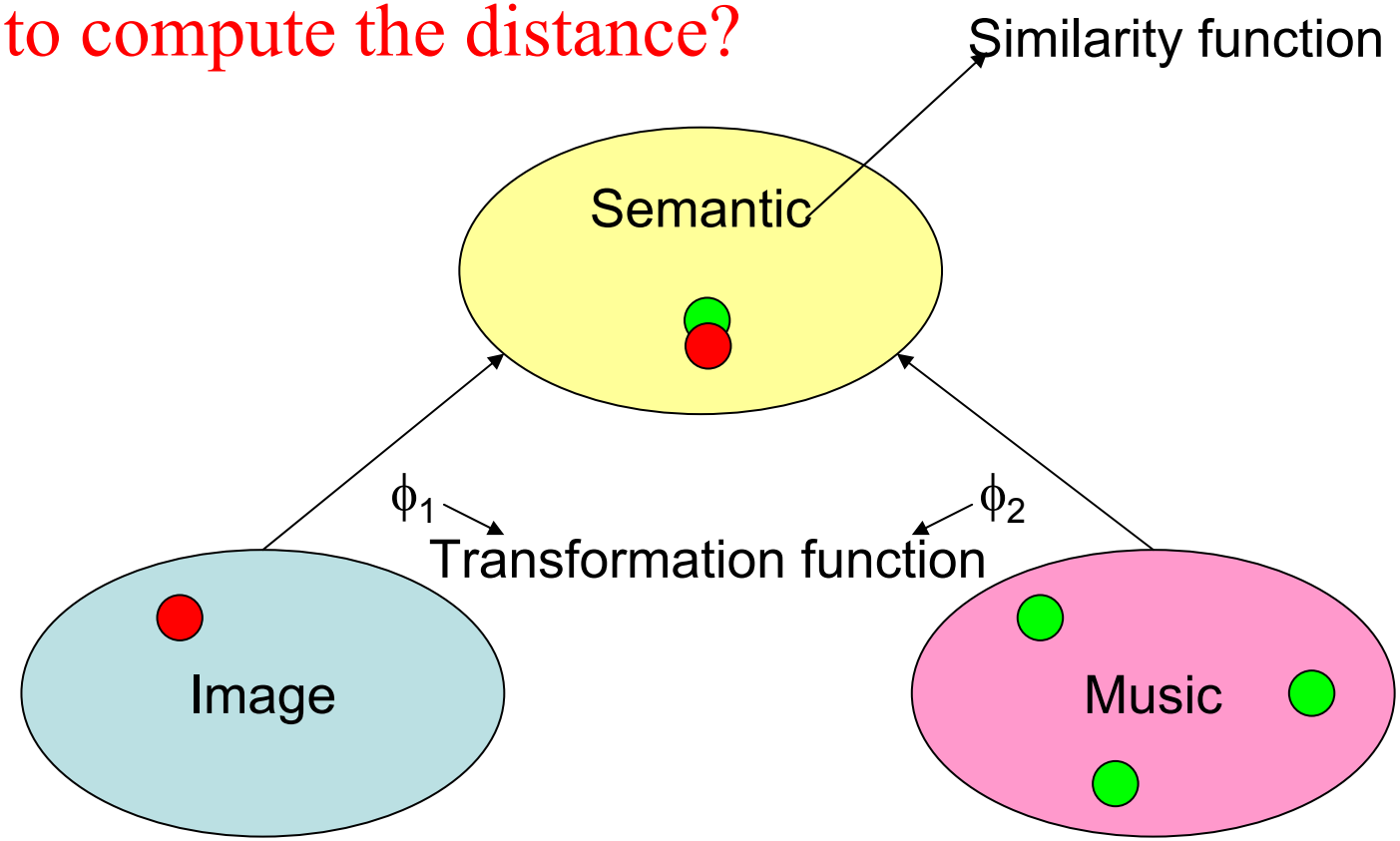
和緩平靜：0.8

輕快明亮：0.72

確定

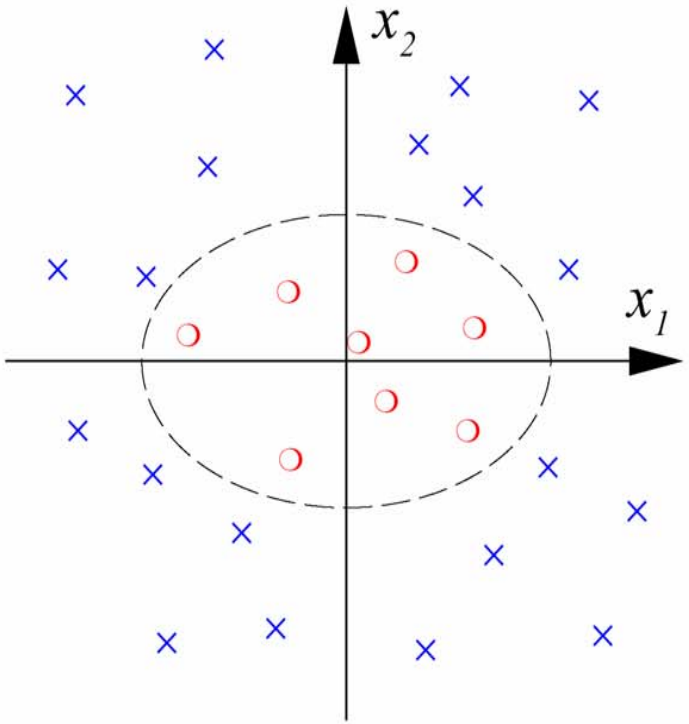
Basic idea (2)

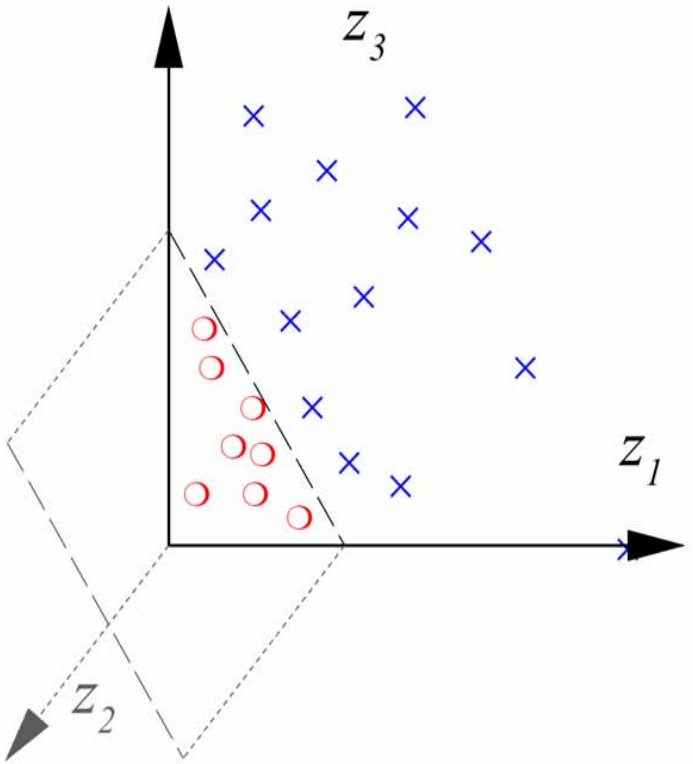
- How to find ϕ_1 and ϕ_2 ?
- How to compute the distance?



SVM

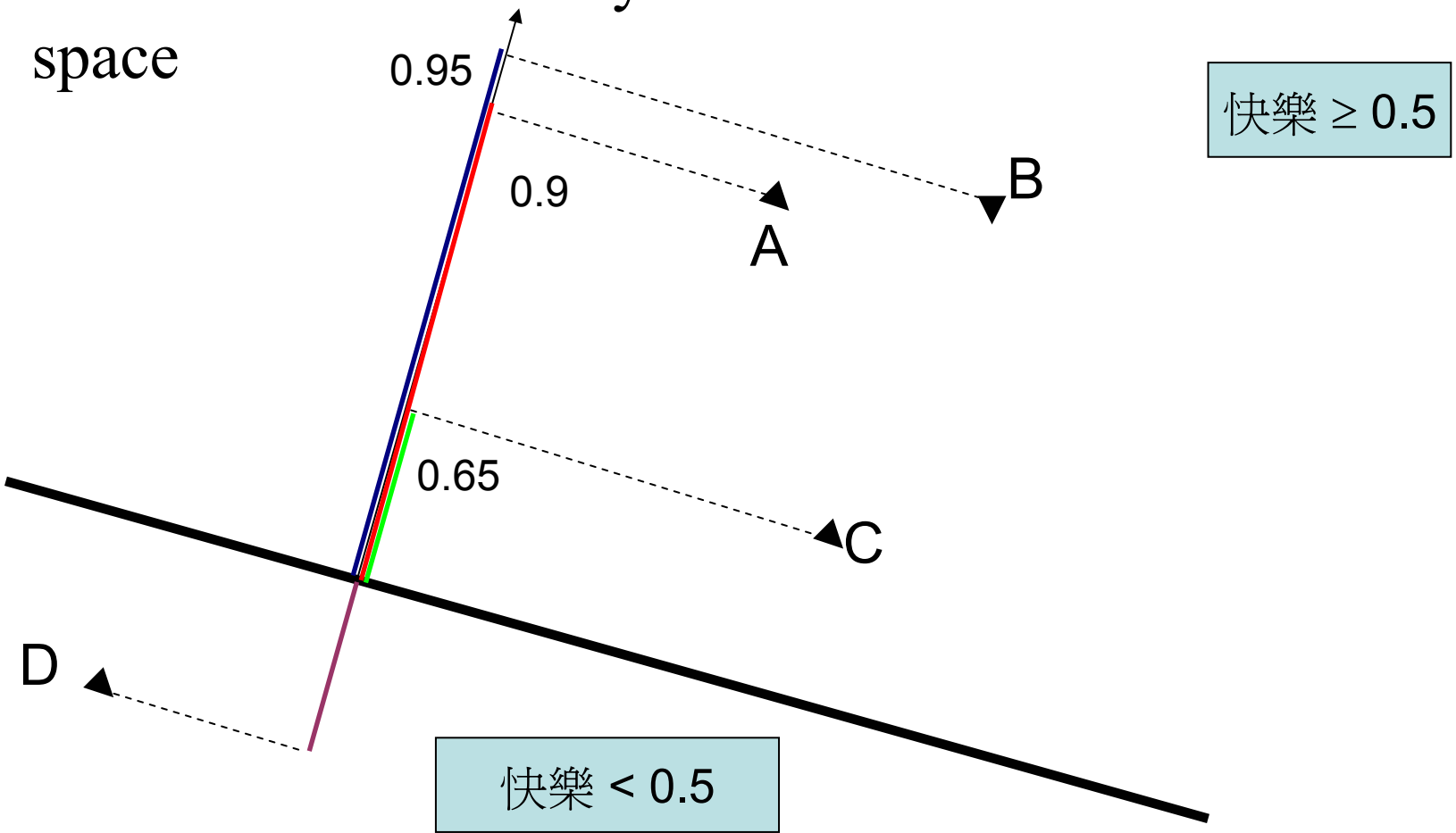
- SVM is a transformation function [Mtiller el al., 2001]
  - **Find the boundaries in the semantic space**





Basic idea (3)

- Distances estimated by boundaries in the semantic space

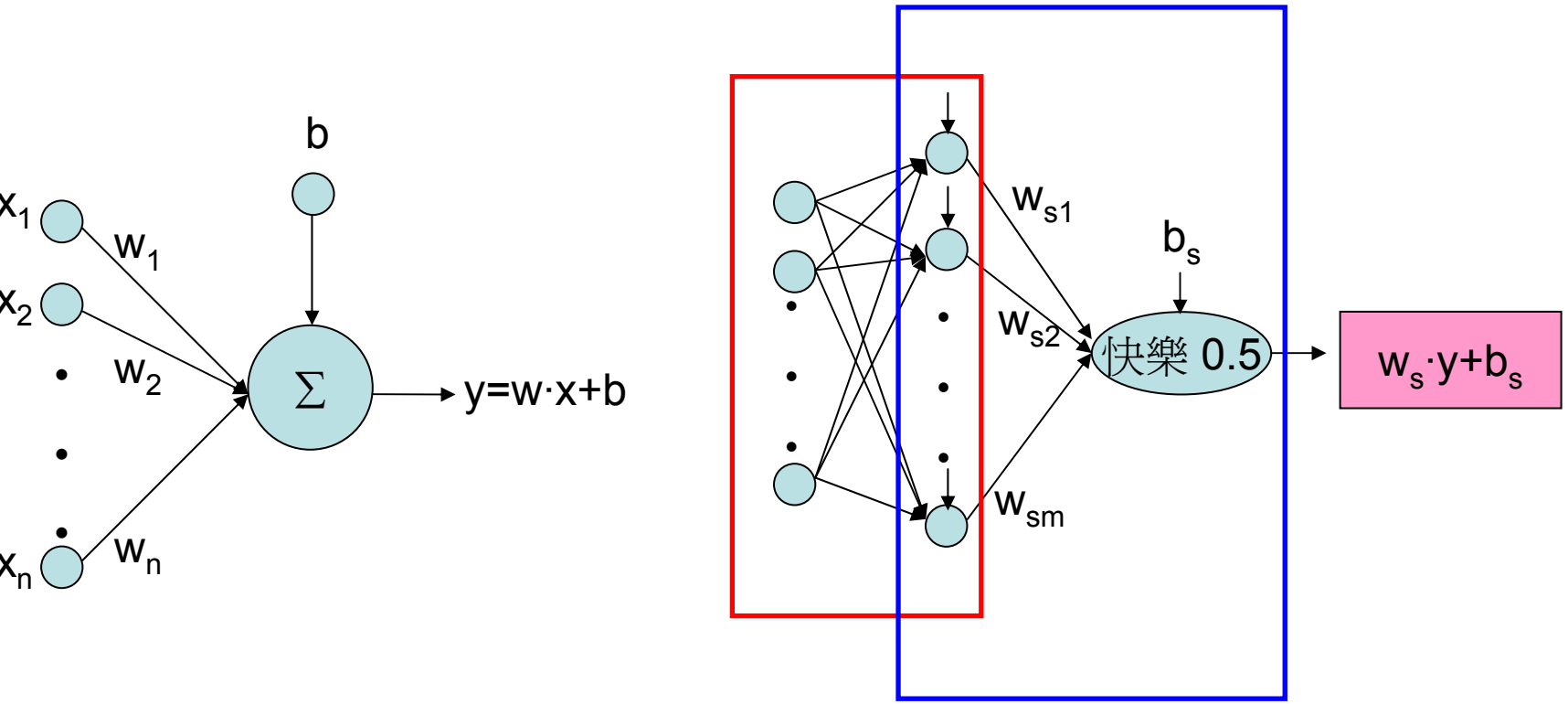


Main Issue (3)

- It is hard for users to specify what they want.
  - SVM + Feedback [Tong and Chang, 2001]
  - Kernel selection [Evgeniou el al., 2003]
- Other solution?
  - Neural Networks [Mtiller el al., 2001]

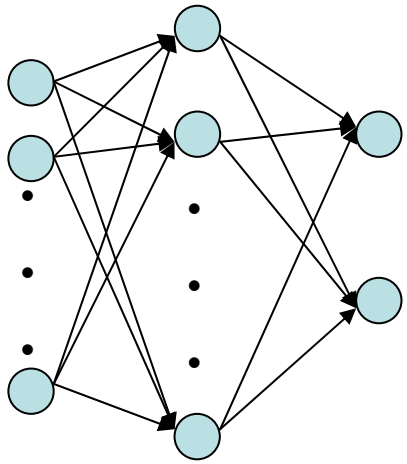
Neural Networks

- Find the boundaries in the semantic space (?)



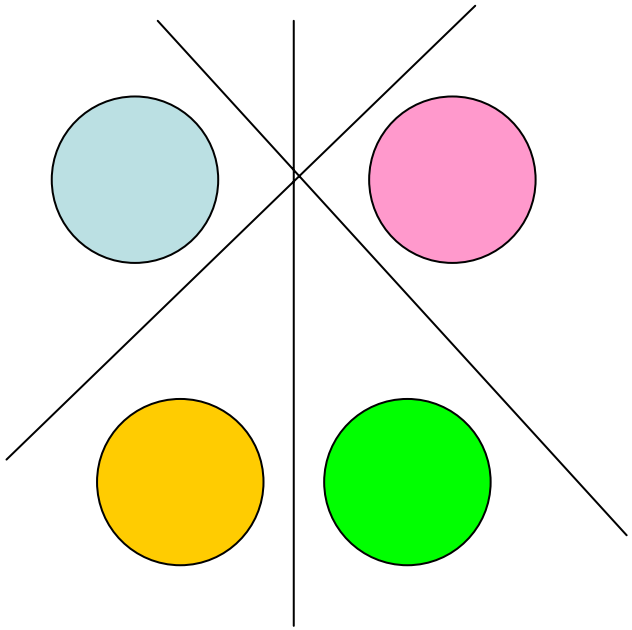
Basic idea (4)

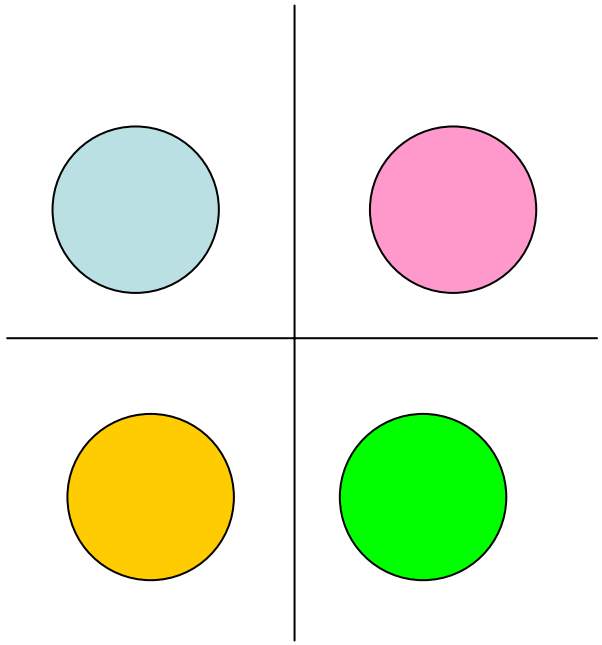
- Neural Networks + Feedback
  - Number of perceptrons
  - Initial weights
  - Training speed



Basic idea (5)

- Perceptrons ≡ split planes (?)
  - Find good split planes

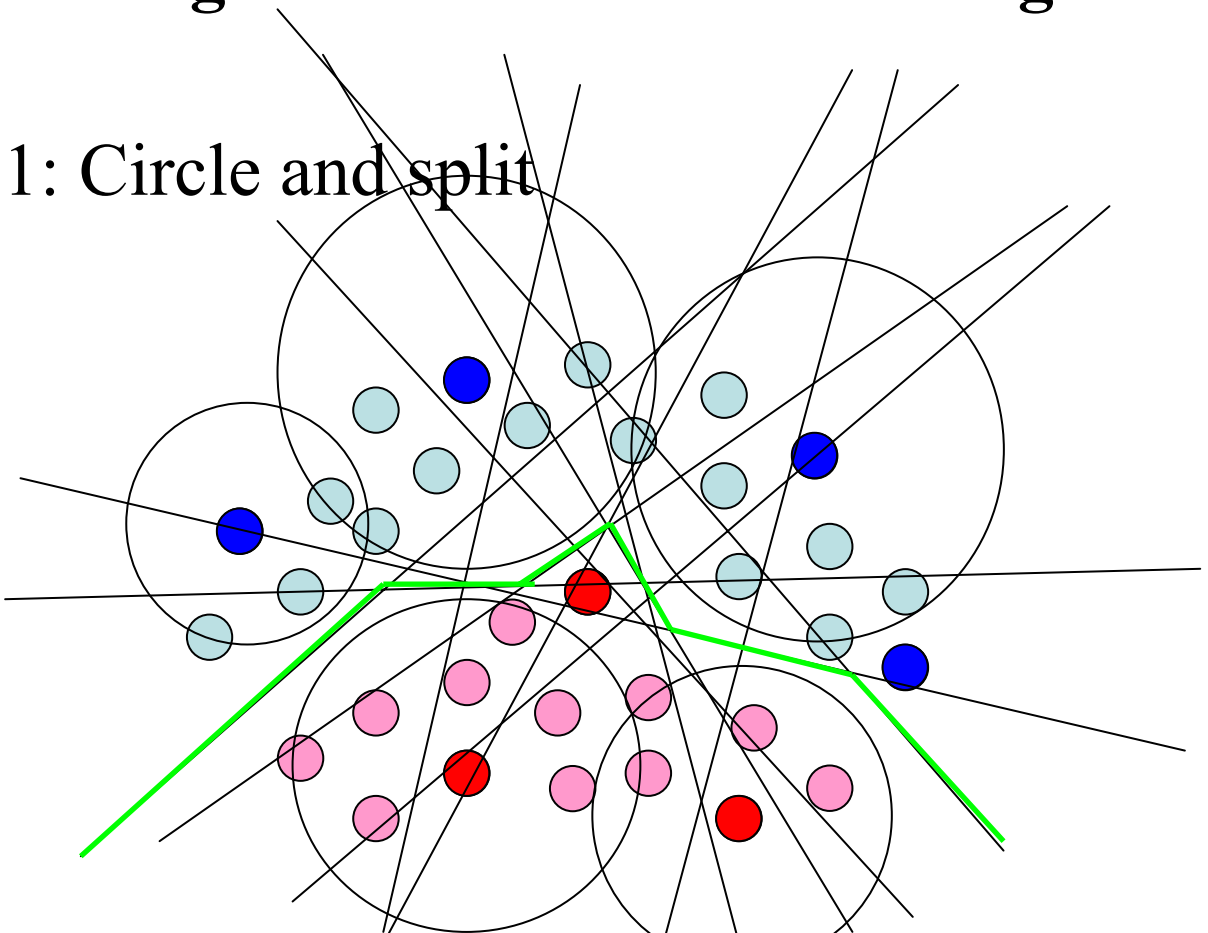




Basic idea (6-1)

- **Constructing neural networks from a geometric view**

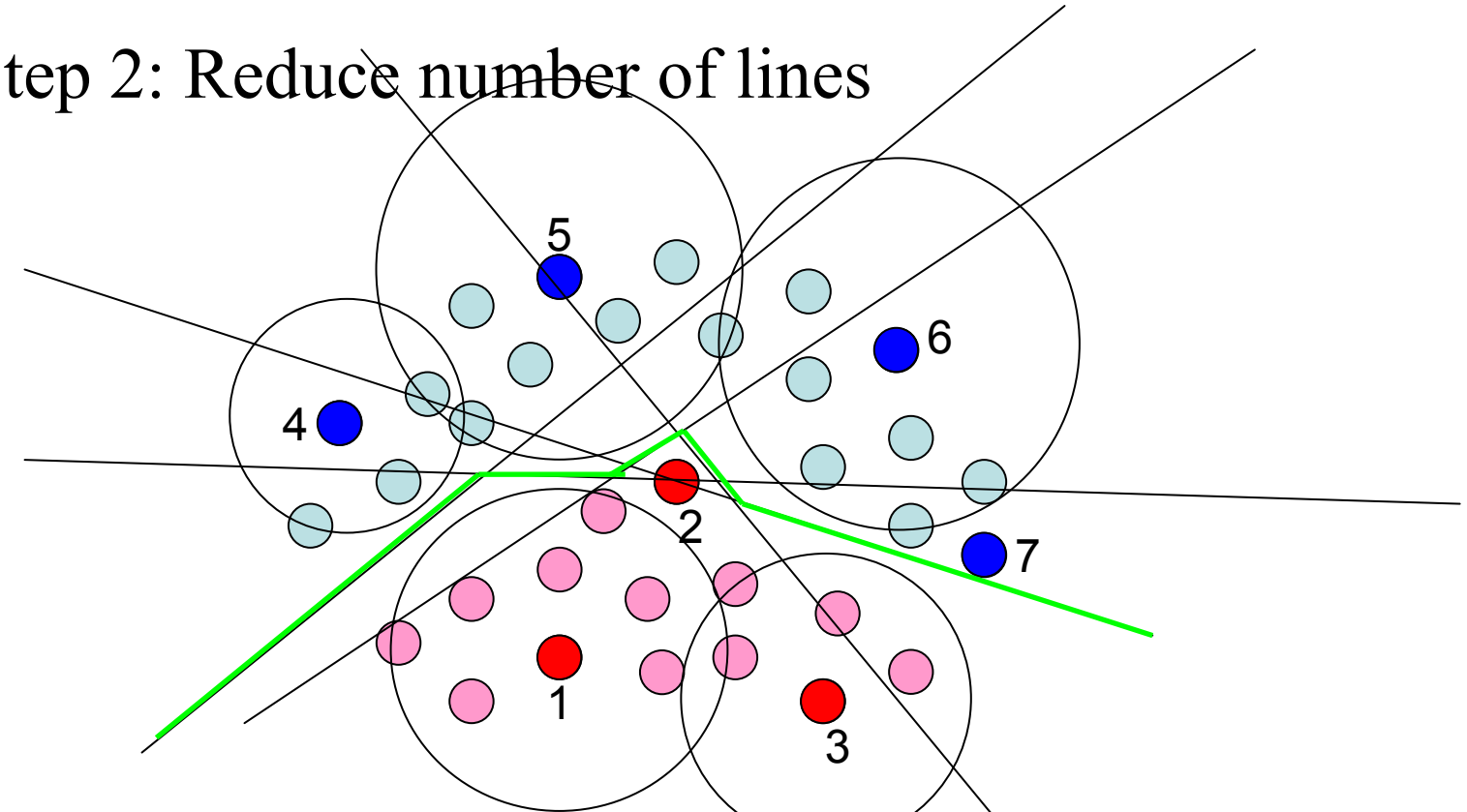
  - Step 1: Circle and split



Basic idea (6-2)

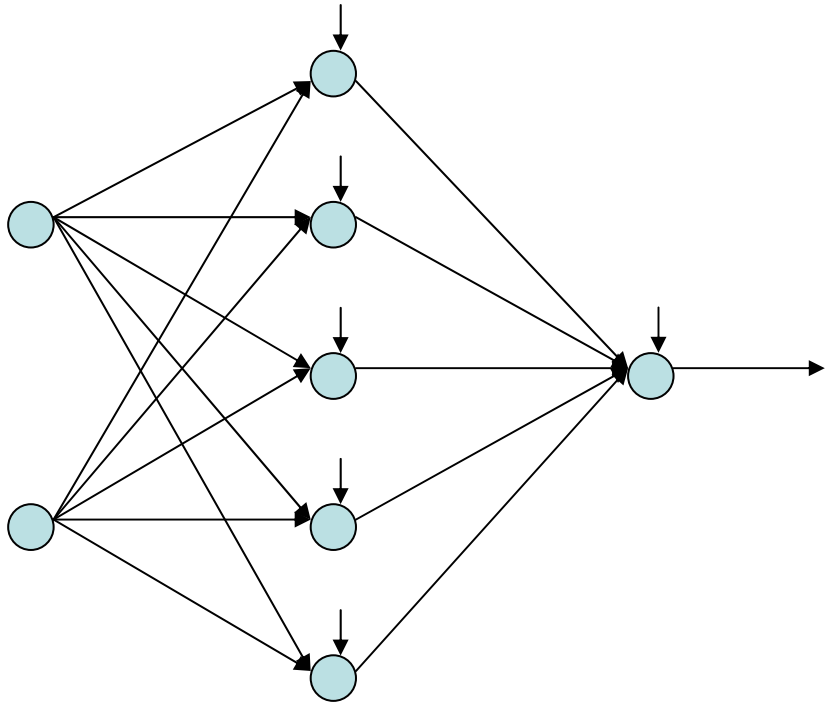
- **Constructing neural networks from a geometric view**

  - Step 2: Reduce number of lines



Basic idea (6-3)

- **Constructing neural networks from a geometric view**
  - Step 3: Construct the NN



Summary (1)

- **Problems in cross-media data retrieval**
  - Main Issue (1)
  - Main Issue (2)
  - Main Issue (3)
- **Basic ideas**
  - Put into the same feature space
  - Semantic space
  - Distance estimated by boundaries
  - Neural Networks + Feedback
  - Perceptrons ≡ split planes

Summary (2)

- **Basic ideas**
  - Constructing neural networks from a geometric view
    1. Circle and split
    2. Reduce number of lines
    3. Construct the NN

Reference

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