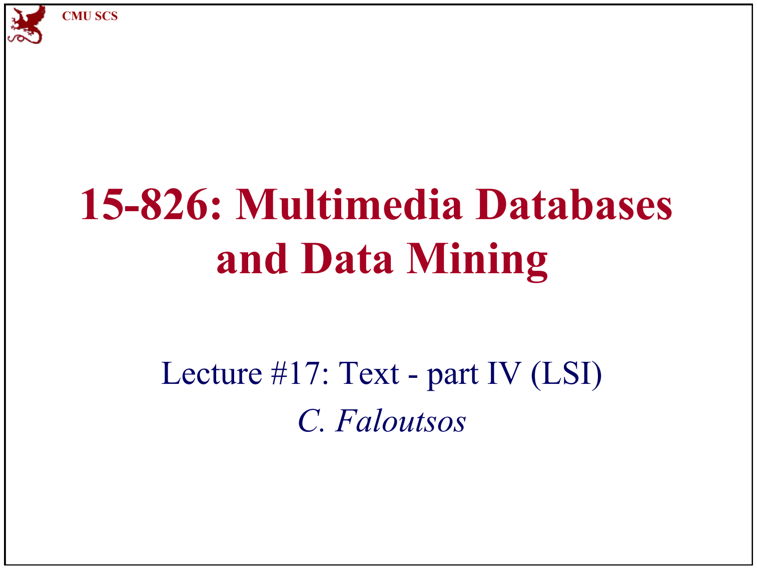
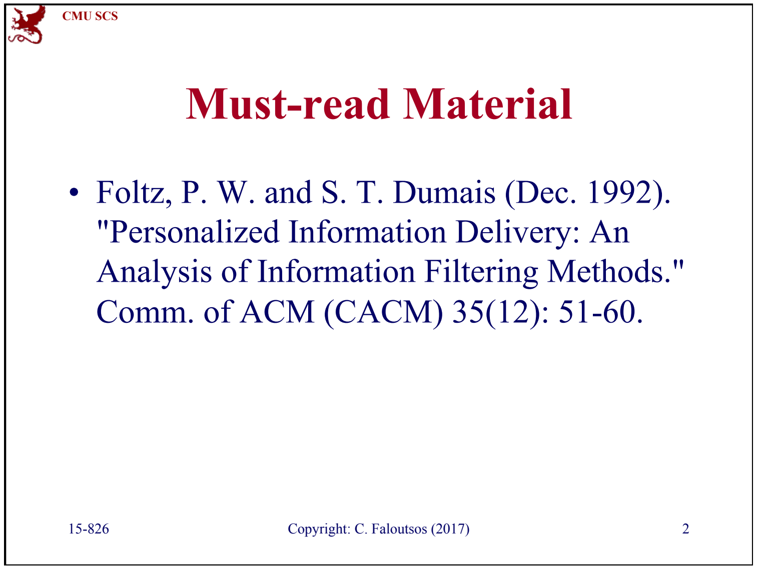


15-826: Multimedia Databases and Data Mining

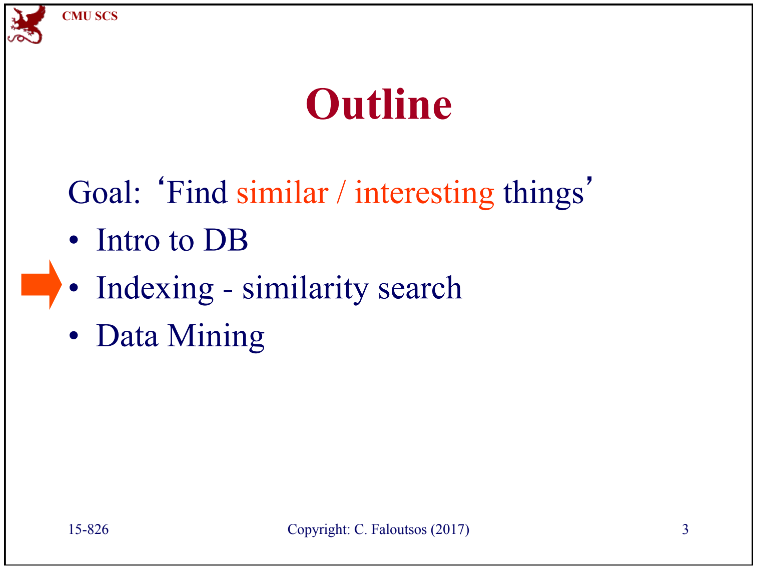
Lecture #17: Text - part IV (LSI)

C. Faloutsos



Must-read Material

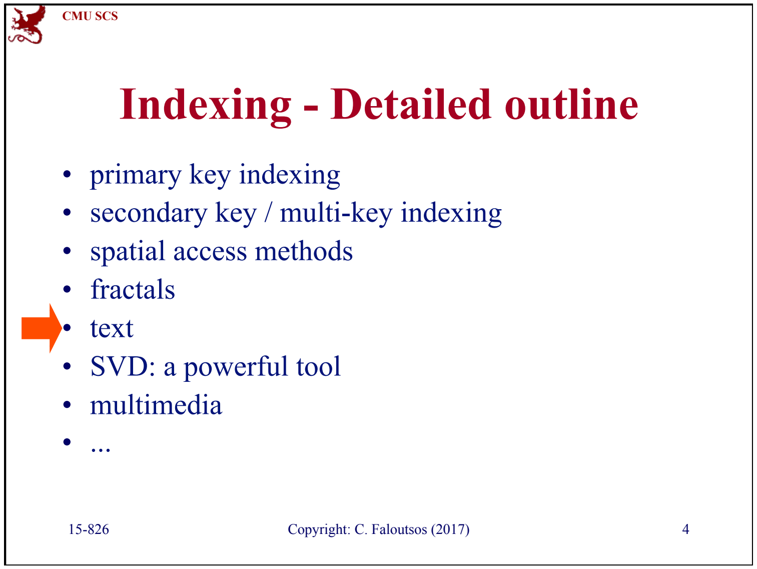
- Foltz, P. W. and S. T. Dumais (Dec. 1992). "Personalized Information Delivery: An Analysis of Information Filtering Methods." Comm. of ACM (CACM) 35(12): 51-60.



Outline

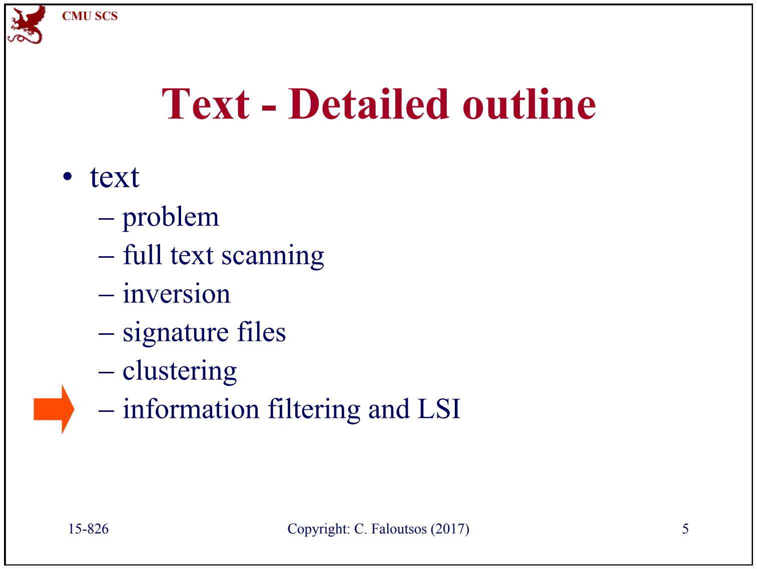
Goal: ‘Find similar / interesting things’

- Intro to DB
- ➡ Indexing - similarity search
- Data Mining



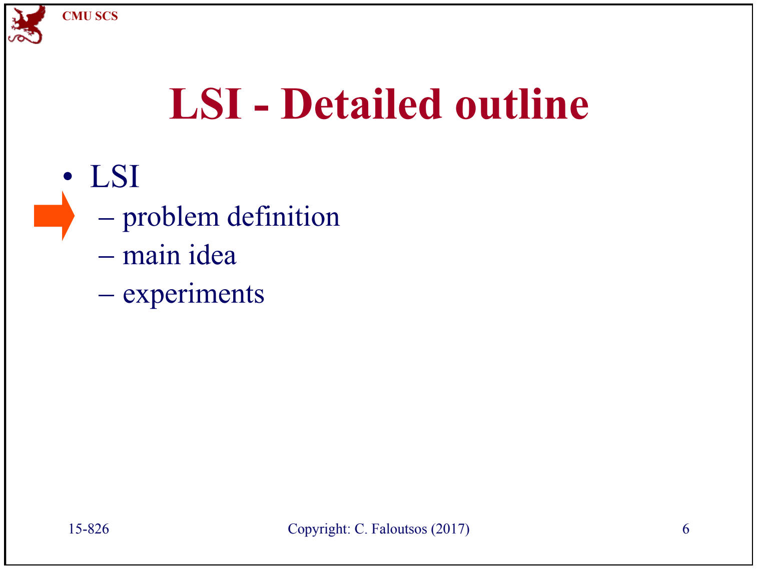
Indexing - Detailed outline

- primary key indexing
- secondary key / multi-key indexing
- spatial access methods
- fractals
- ➡ text
- SVD: a powerful tool
- multimedia
- ...



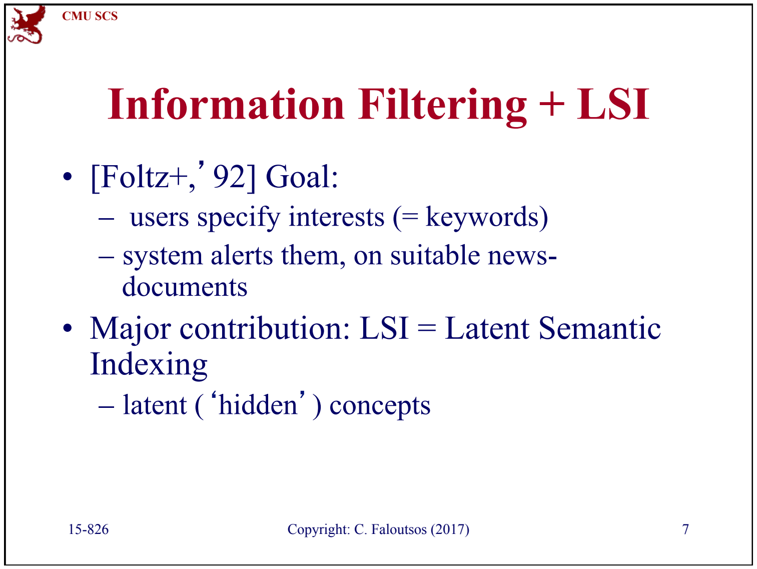
Text - Detailed outline

- text
  - problem
  - full text scanning
  - inversion
  - signature files
  - clustering
  - information filtering and LSI



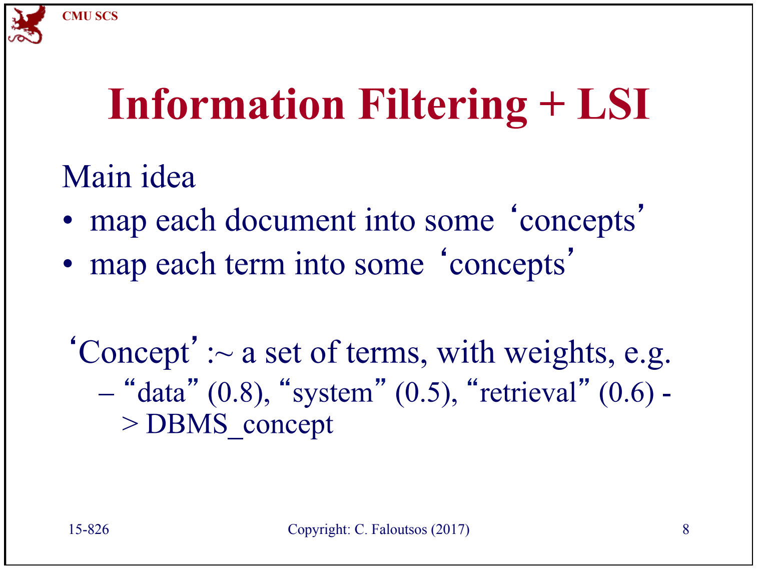
LSI - Detailed outline

- LSI
  - problem definition
  - main idea
  - experiments



Information Filtering + LSI

- [Foltz+,' 92] Goal:
  - users specify interests (= keywords)
  - system alerts them, on suitable news-documents
- Major contribution: LSI = Latent Semantic Indexing
  - latent ('hidden') concepts



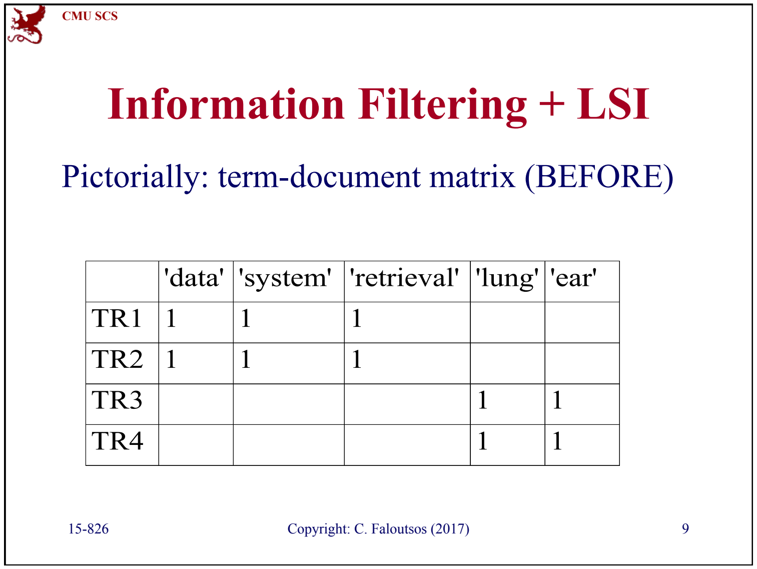
Information Filtering + LSI

Main idea

- map each document into some 'concepts'
- map each term into some 'concepts'

'Concept' :~ a set of terms, with weights, e.g.

- "data" (0.8), "system" (0.5), "retrieval" (0.6) -> DBMS_concept

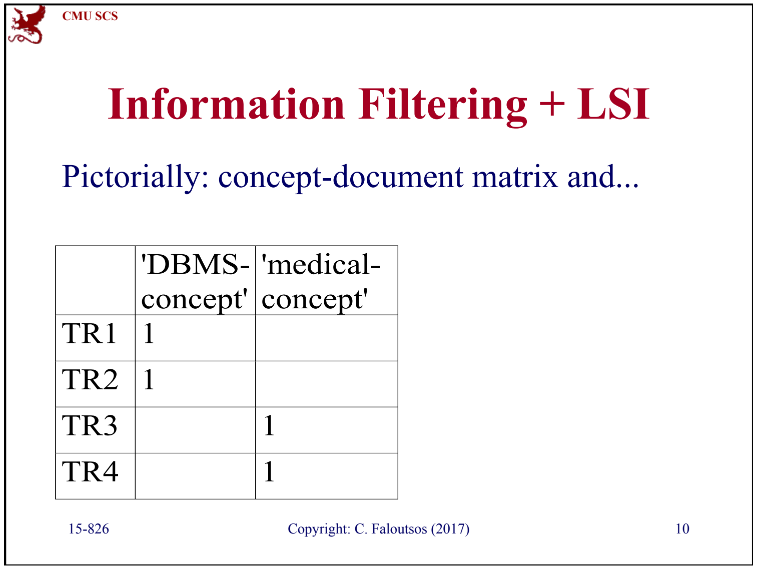


CMU SCS

Information Filtering + LSI

Pictorially: term-document matrix (BEFORE)

	'data'	'system'	'retrieval'	'lung'	'ear'
TR1	1	1	1		
TR2	1	1	1		
TR3				1	1
TR4				1	1



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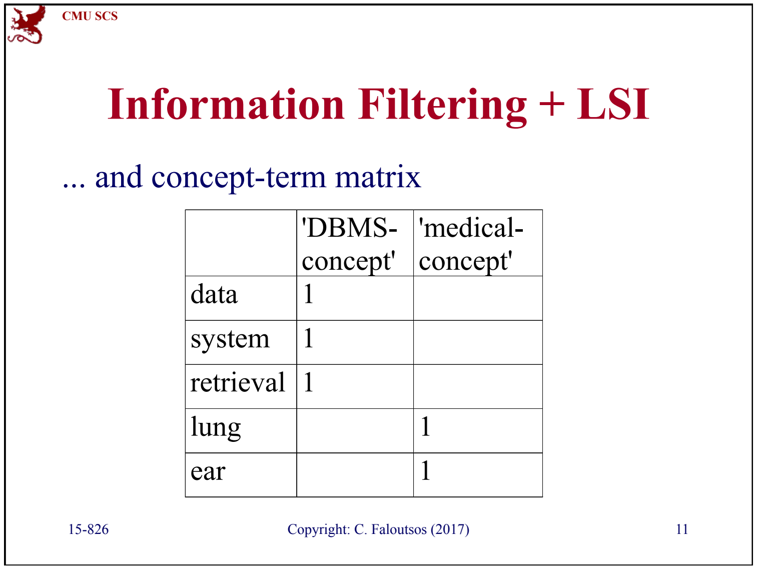
Information Filtering + LSI

Pictorially: concept-document matrix and...

	'DBMS-concept'	'medical-concept'
TR1	1	
TR2	1	
TR3		1
TR4		1



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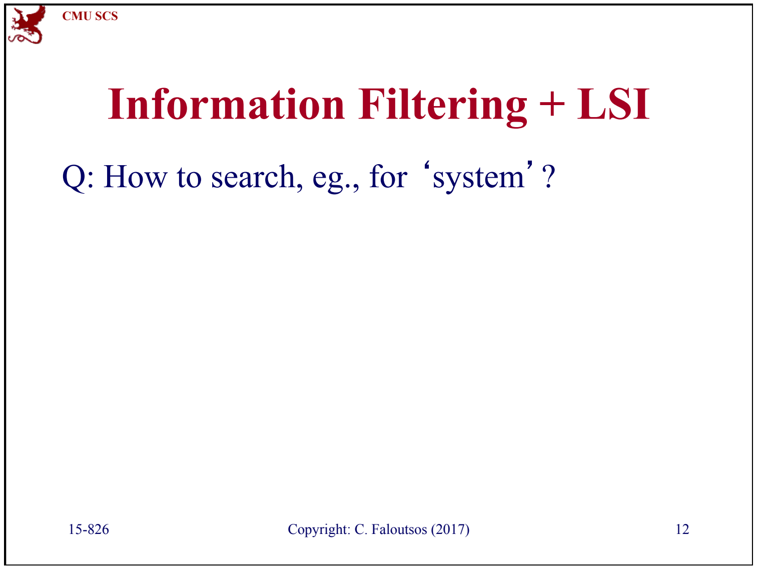
Information Filtering + LSI

... and concept-term matrix

	'DBMS-concept'	'medical-concept'
data	1	
system	1	
retrieval	1	
lung		1
ear		1



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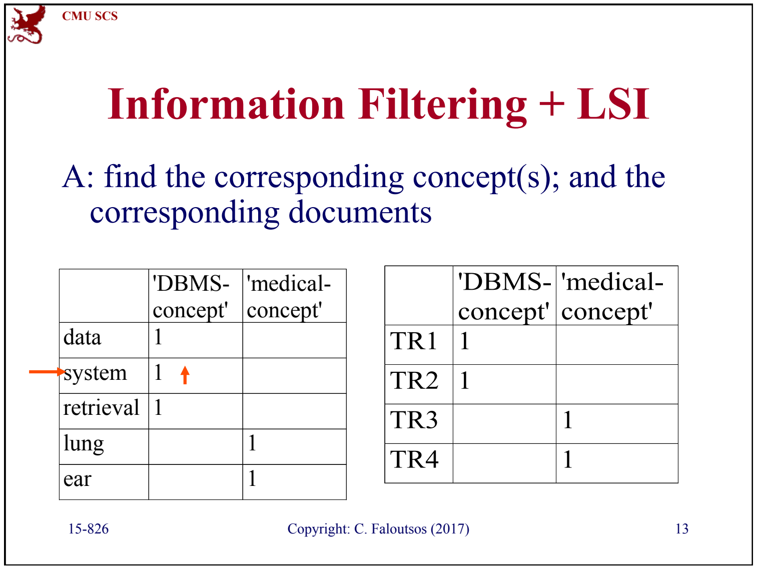
Information Filtering + LSI

Q: How to search, eg., for ‘system’?



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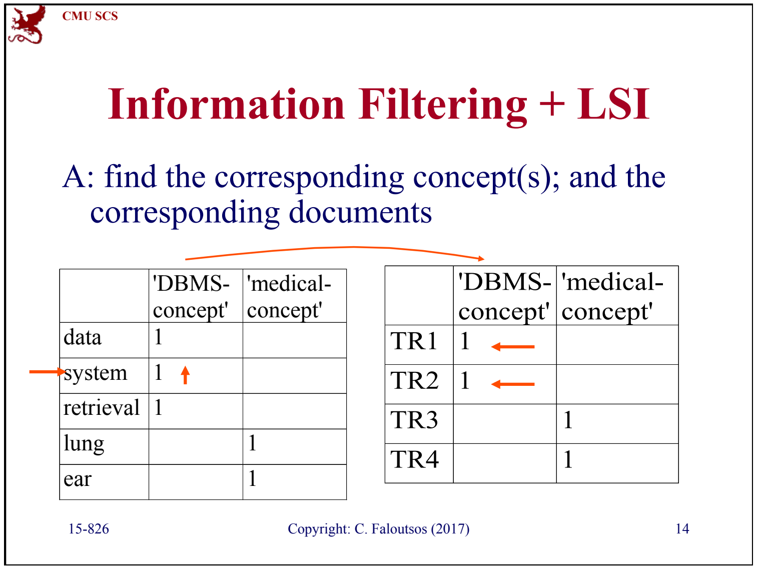
Information Filtering + LSI

A: find the corresponding concept(s); and the corresponding documents

	'DBMS-concept'	'medical-concept'
data	1	
system	1	
retrieval	1	
lung		1
ear		1

	'DBMS-concept'	'medical-concept'
TR1	1	
TR2	1	
TR3		1
TR4		1



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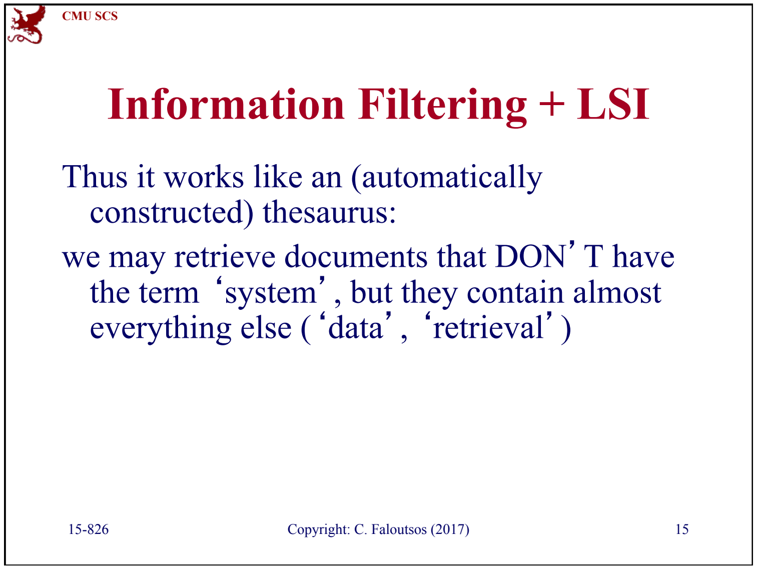
Information Filtering + LSI

A: find the corresponding concept(s); and the corresponding documents

	'DBMS-concept'	'medical-concept'
data	1	
system	1	
retrieval	1	
lung		1
ear		1

	'DBMS-concept'	'medical-concept'
TR1	1	
TR2	1	
TR3		1
TR4		1



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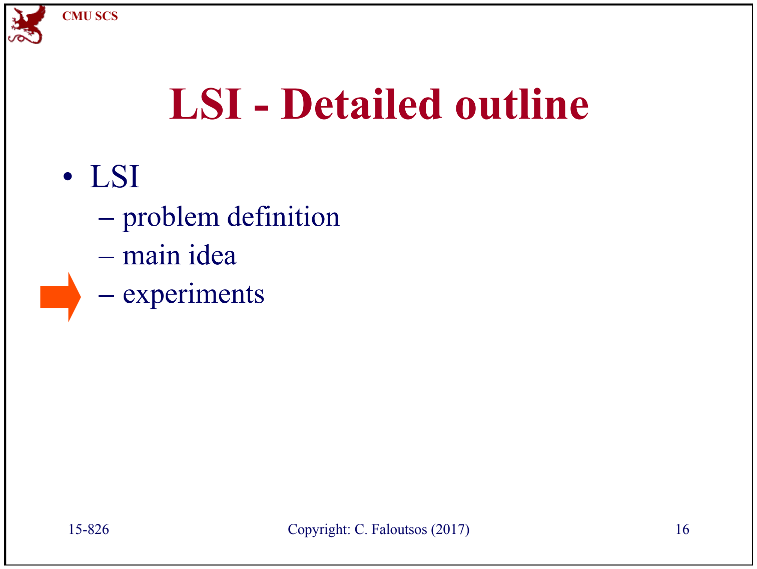
Information Filtering + LSI

Thus it works like an (automatically constructed) thesaurus:

we may retrieve documents that DON’T have the term ‘system’, but they contain almost everything else (‘data’, ‘retrieval’)



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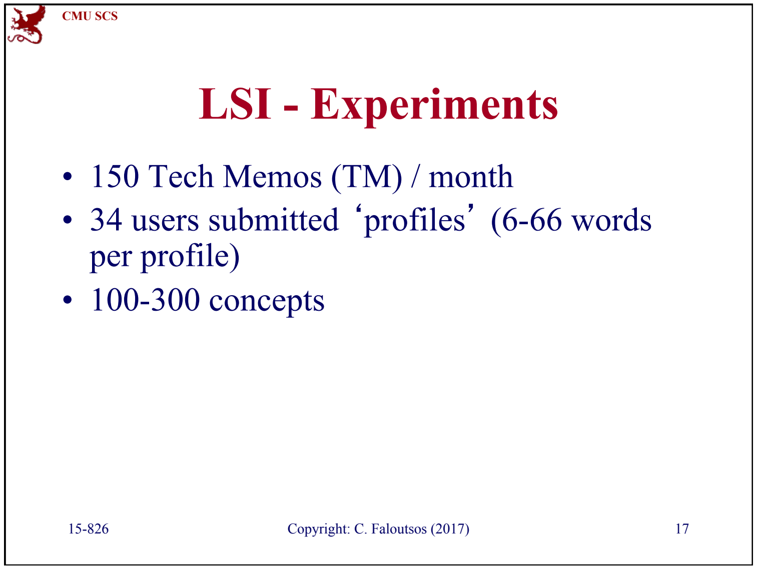
LSI - Detailed outline

- LSI
  - problem definition
  - main idea
  - experiments



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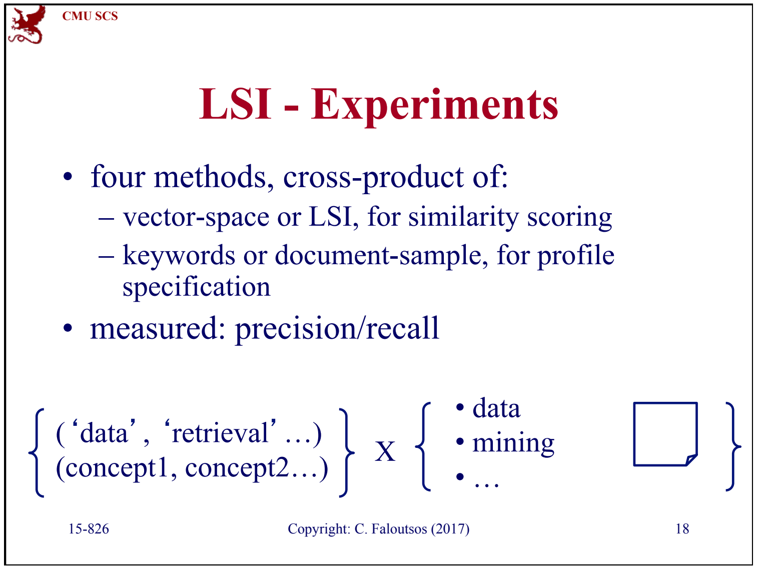
LSI - Experiments

- 150 Tech Memos (TM) / month
- 34 users submitted ‘profiles’ (6-66 words per profile)
- 100-300 concepts



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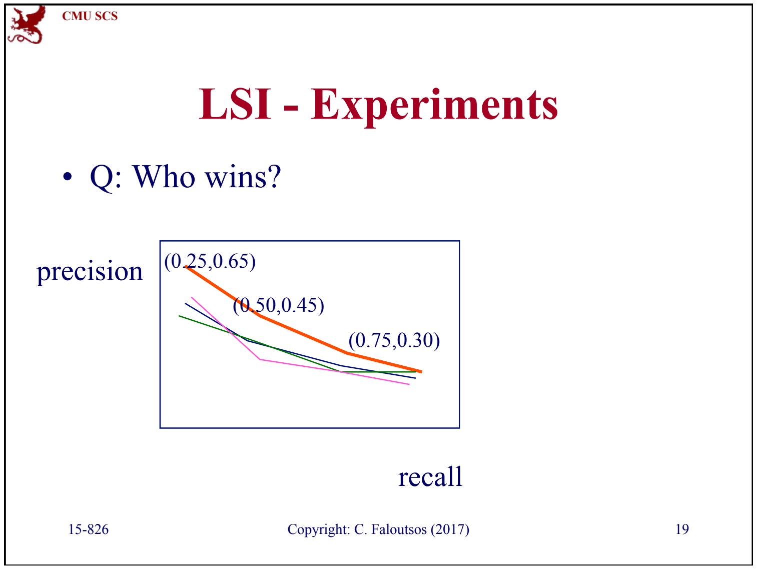
LSI - Experiments

- four methods, cross-product of:
  - vector-space or LSI, for similarity scoring
  - keywords or document-sample, for profile specification
- measured: precision/recall

{ (‘data’, ‘retrieval’ …) (concept1, concept2…) } X { • data • mining • … }



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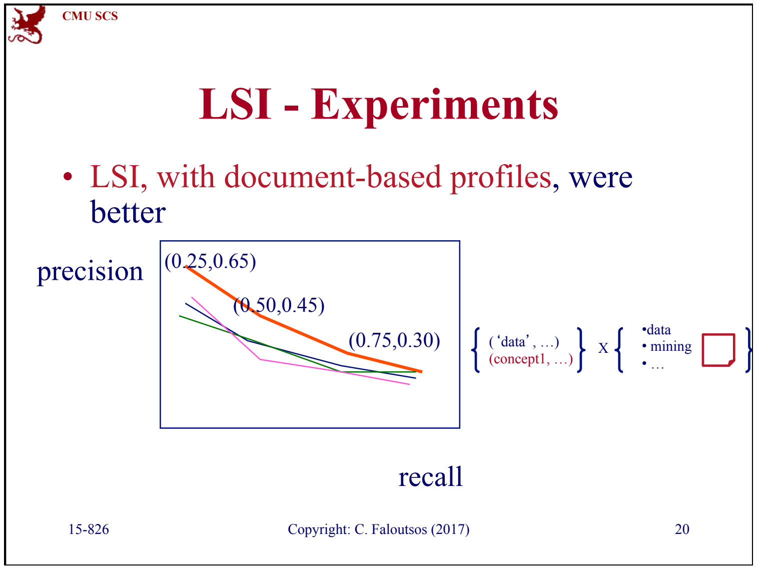
LSI - Experiments

- Q: Who wins?



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LSI - Experiments

- LSI, with document-based profiles, were better

LSI - Discussion - Conclusions

- Great idea,
  - to derive ‘concepts’ from documents
  - to build a ‘statistical thesaurus’ automatically
  - to reduce dimensionality
- Often leads to better precision/recall
- but:
  - Needs ‘training’ set of documents
  - ‘concept’ vectors are not sparse anymore

LSI - Discussion - Conclusions

Observations

- Bellcore (-> Telcordia) has a patent
- used for multi-lingual retrieval

How exactly SVD works? (Details, next)

	'data'	'system'	'retrieval'	'lung'	'ear'
TR1	1	1	1		
TR2	1	1	1		
TR3				1	1
TR4				1	1

	'DBMS-concept'	'medical-concept'
TR1	1	
TR2	1	
TR3		1
TR4		1

	'DBMS-concept'	'medical-concept'
data	1	
system	1	
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lung		1
ear		1