Applied Text Analytics & Natural Language Processing

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Topic Modeling
Latent Semantic Indexing

This lecture is adopted based on Polo Chau LSI slides in DVA

Learning Objectives

In this lesson, you will learn a topic-learning model named as Latent Semantic Indexing (LSI)

- SVD
- Document-term matrix
- Queries with LSI

What is Topic Modeling?

It is an unsupervised learning technique (no labels needed) to extract topics from documents and find documents that potentially share a common context.

This technique is used to query documents that may not have all the keywords, but are still related to a topic.

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

Latent Semantic Indexing (LSI)

Main idea

- Map each **document** into some '**concepts**'
- Map each **term** into some '**concepts**'

'**Concept**': a set of terms, with weights

For example, **DBMS_concept**:

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

We Need to Construct the Document-term Matrix

It is similar to the unigrams Bag of Words:

	data	system	retireval	lung	ear
doc1	1	1	1		
doc2	1	1	1		
doc3				1	1
doc4				1	1

Convert Document-term Matrix into a Concept Matrix

term-concept matrix

	database concept	medical concept
data	1	
system	1	
retrieval	1	
lung		1
ear		1

… and

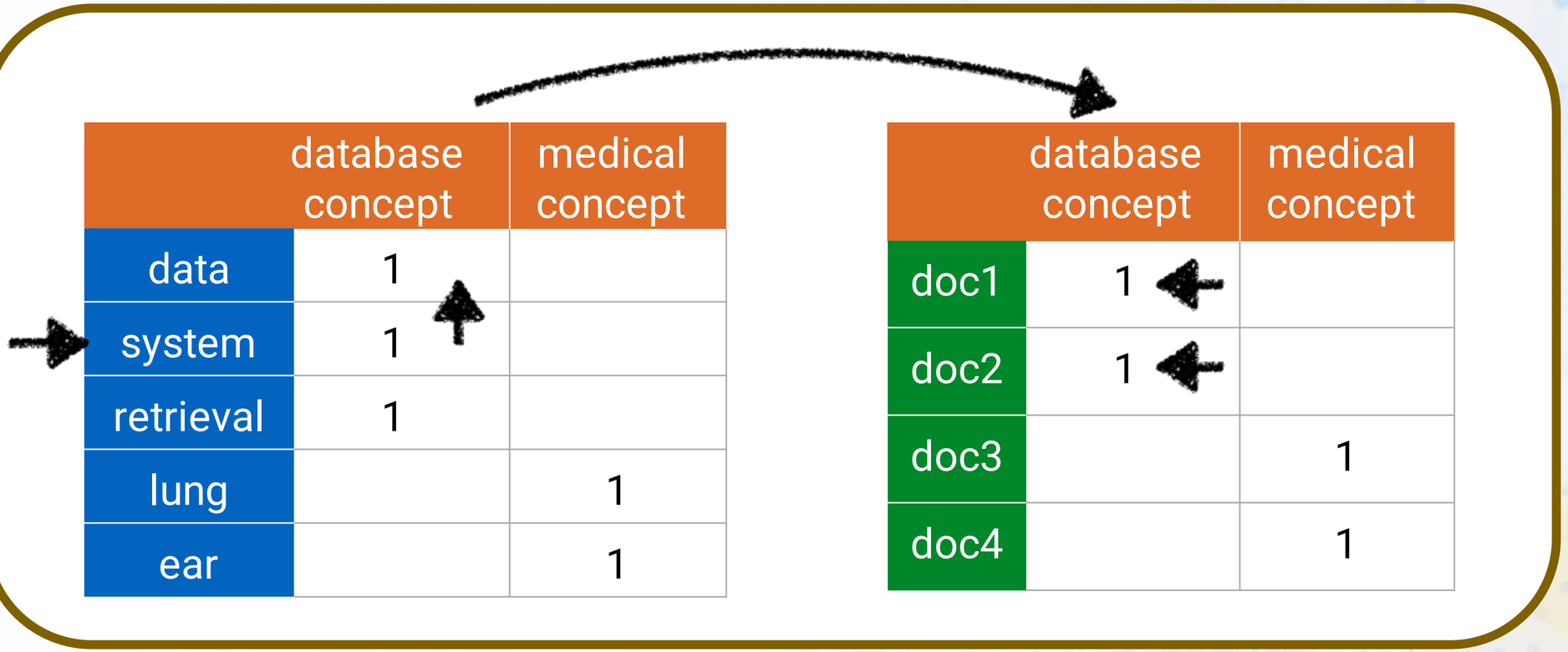
document-concept matrix

	database concept	medical concept
doc1	1	
doc2	1	
doc3		1
doc4		1

Query Using the Concepts

Q: How to search, e.g., for “system”?

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

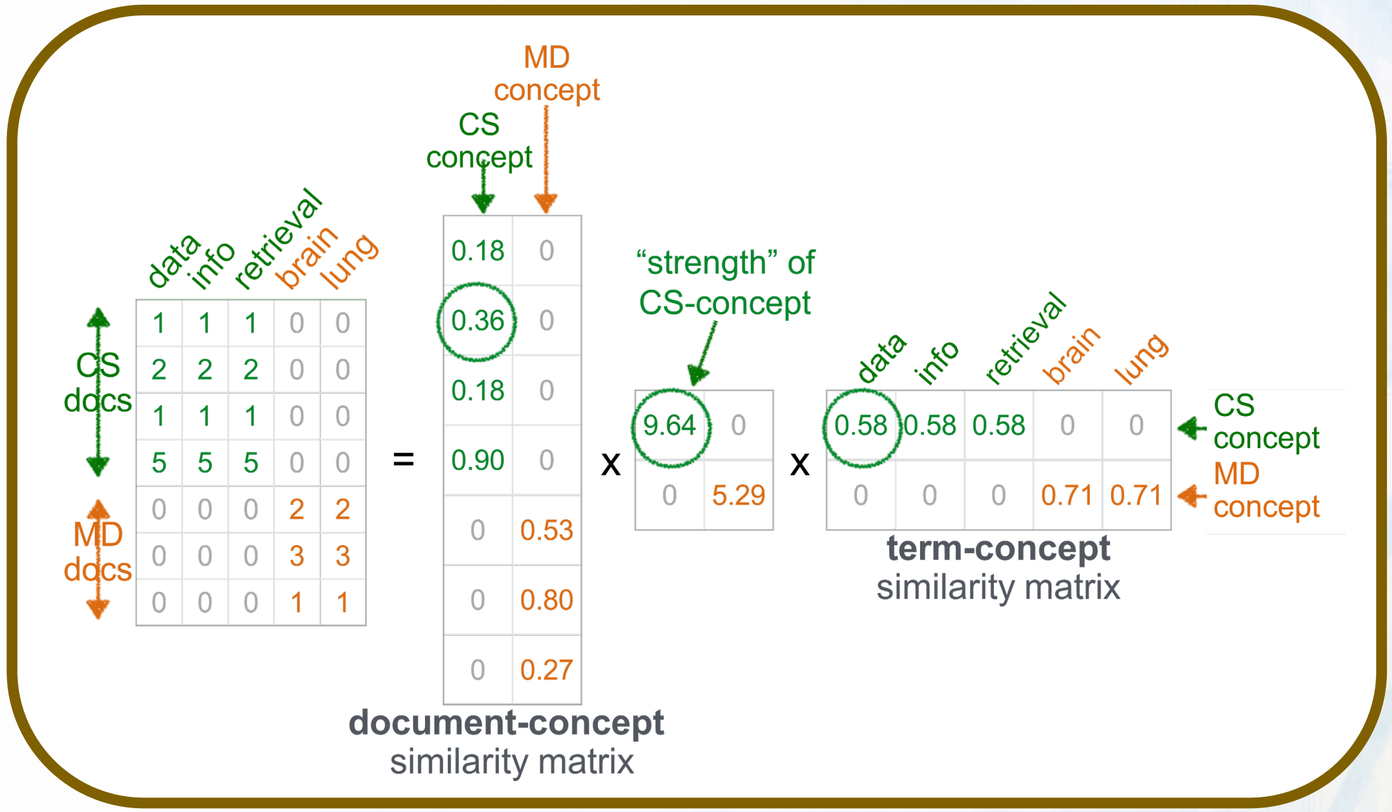


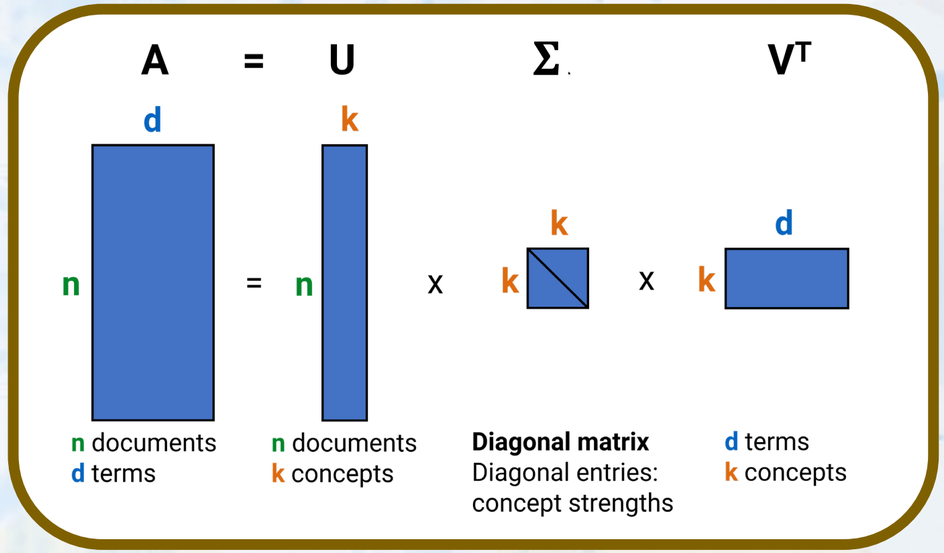
	database concept	medical concept
data	1	
system	1	
retrieval	1	
lung		1
ear		1

	database concept	medical concept
doc1	1	
doc2	1	
doc3		1
doc4		1

We Need SVD to Create the Concepts

(Very similar to what we had for Dimensionality reduction lecture)





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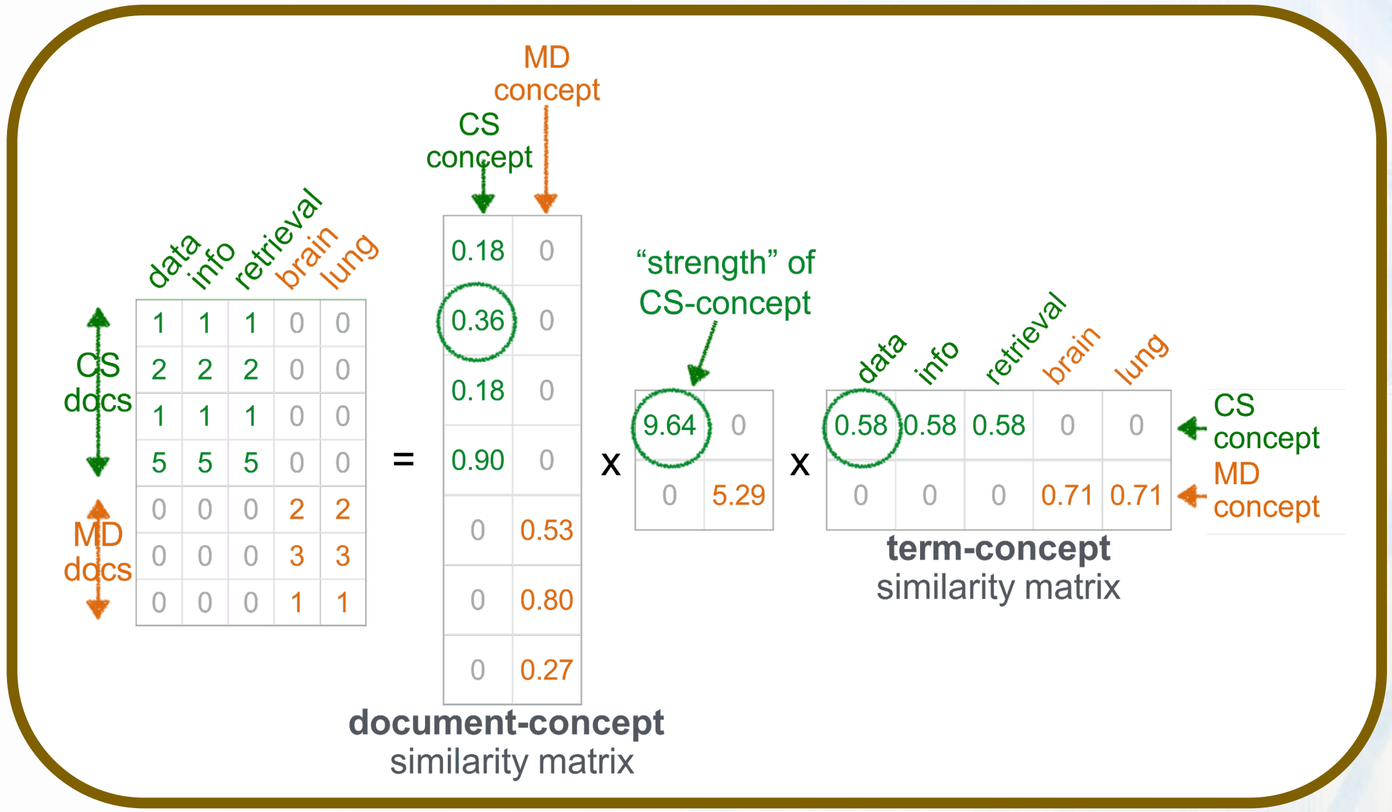
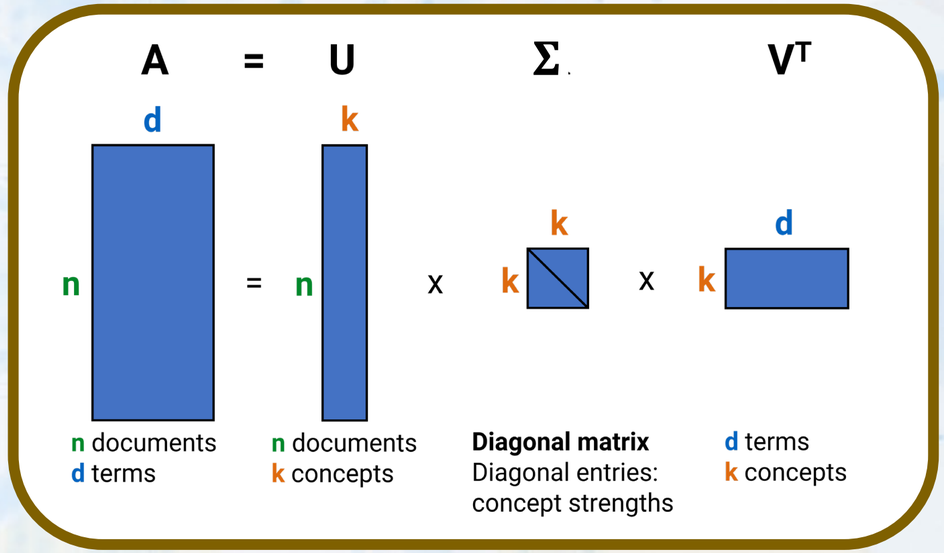
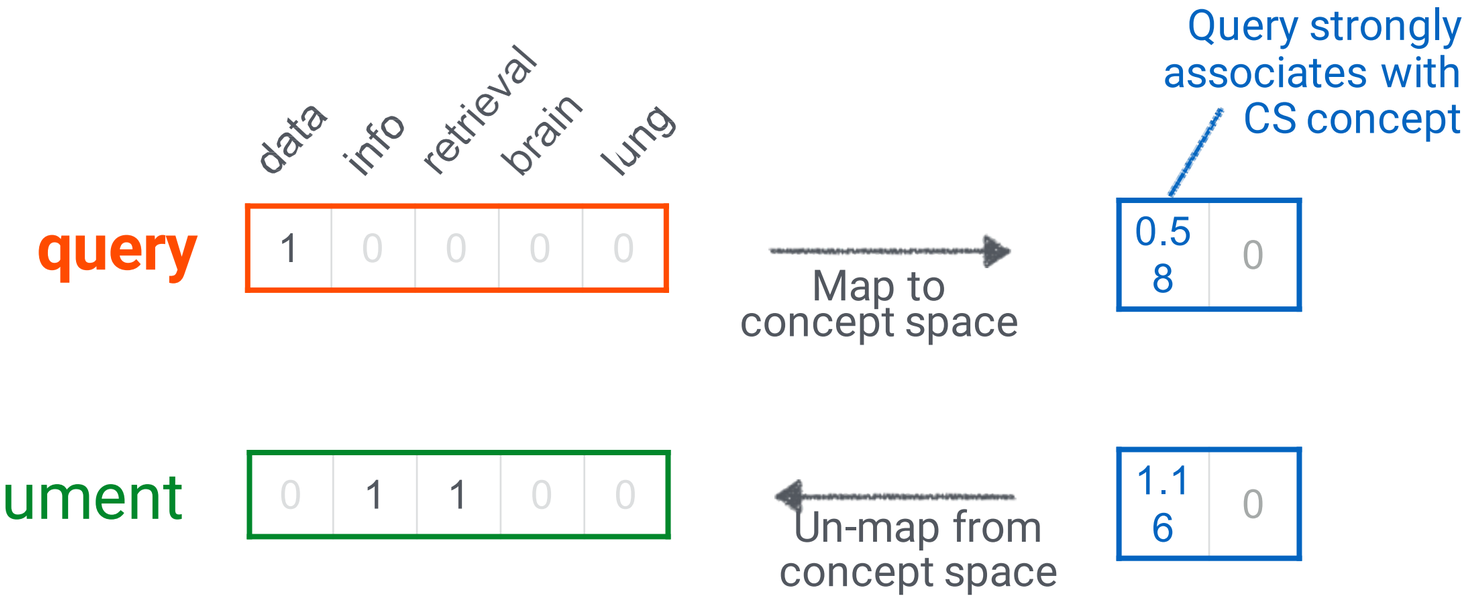




Query on Both Document and Term

Document (‘information’, ‘retrieval’) will be retrieved by **query** (‘data’), even though it does not contain ‘data’!!



Summary

- We learned an unsupervised technique (topic modeling)
- LSI and SVD
- Query