Deduplication with graph algorithms

Tom Michiels

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Hoe kunnen we datascience en machine learning technieken (AI, ChatGPT…) inzetten voor de verbetering van bestaande en de productie van nieuwe openbare statistieken

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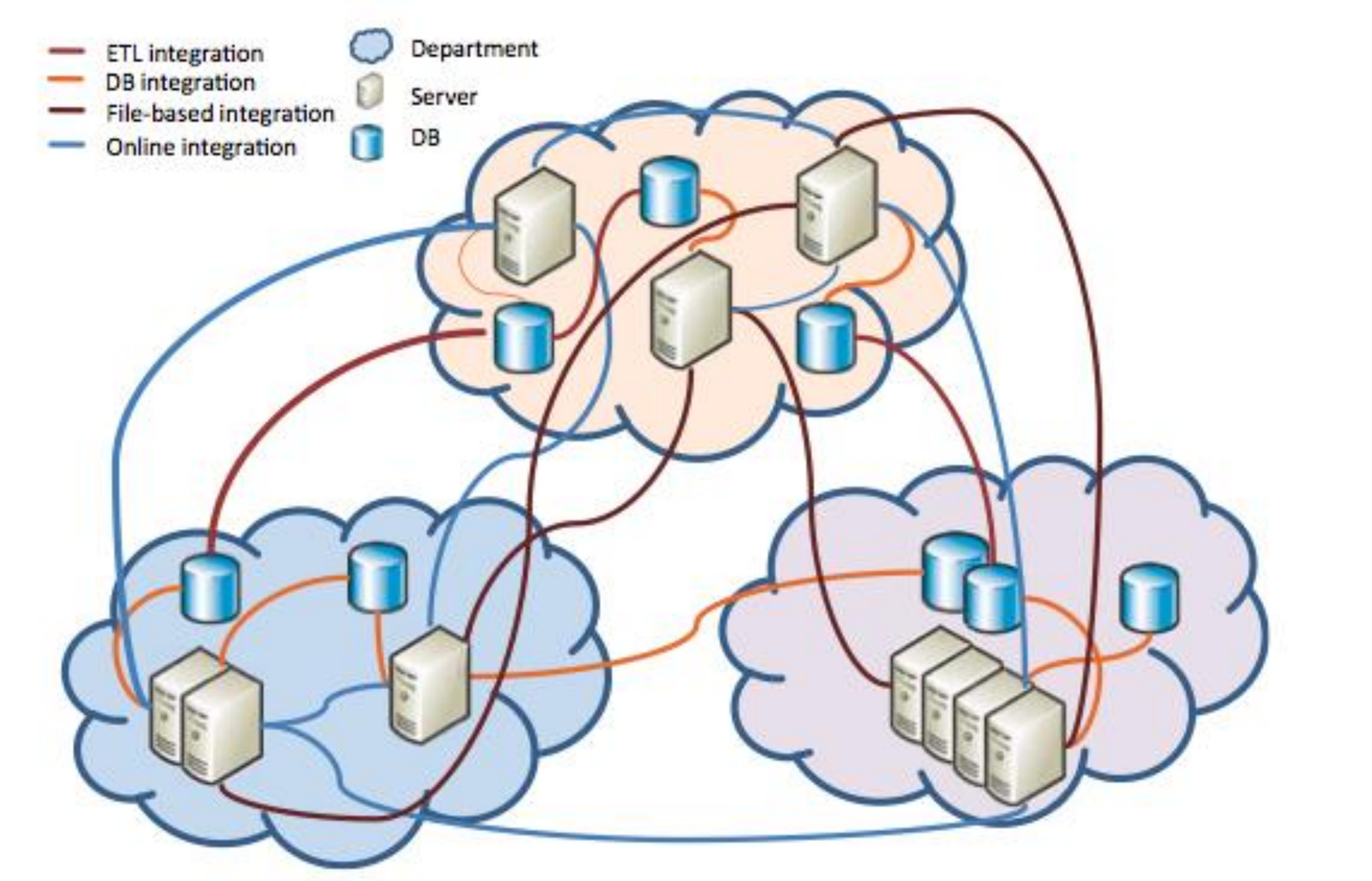
Data Quality



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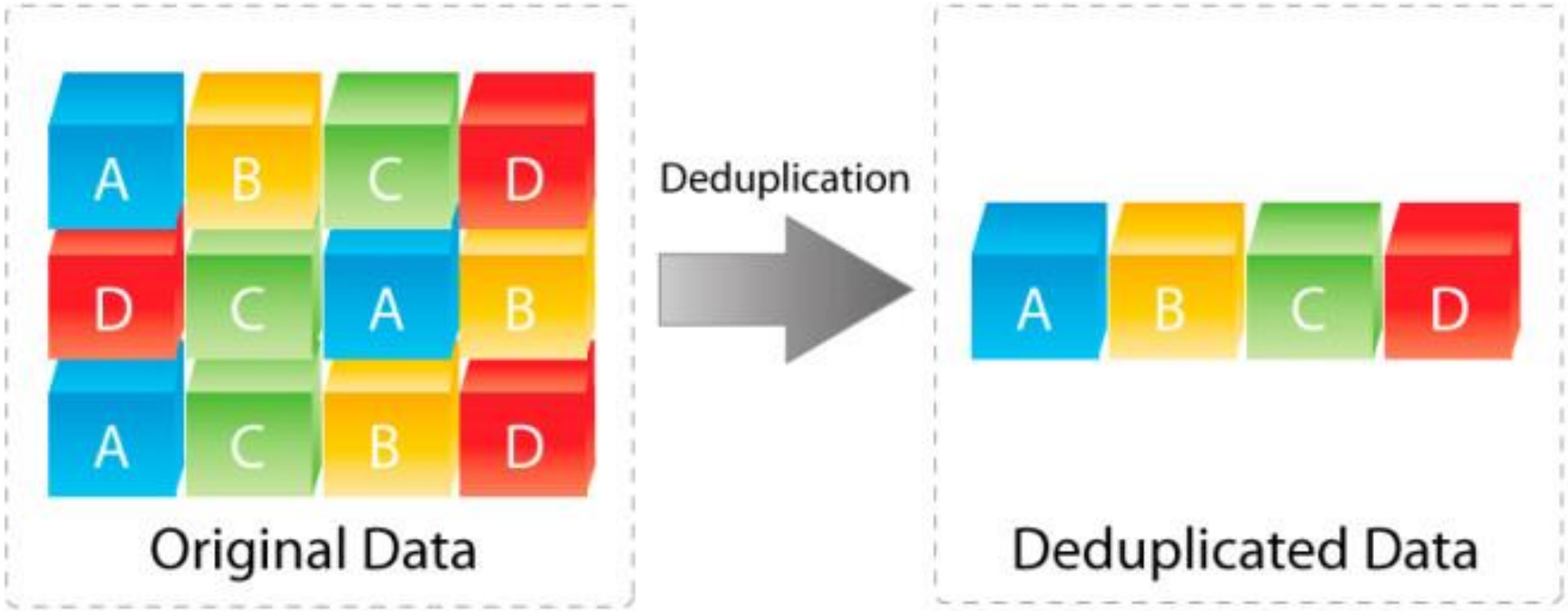
Deduplication



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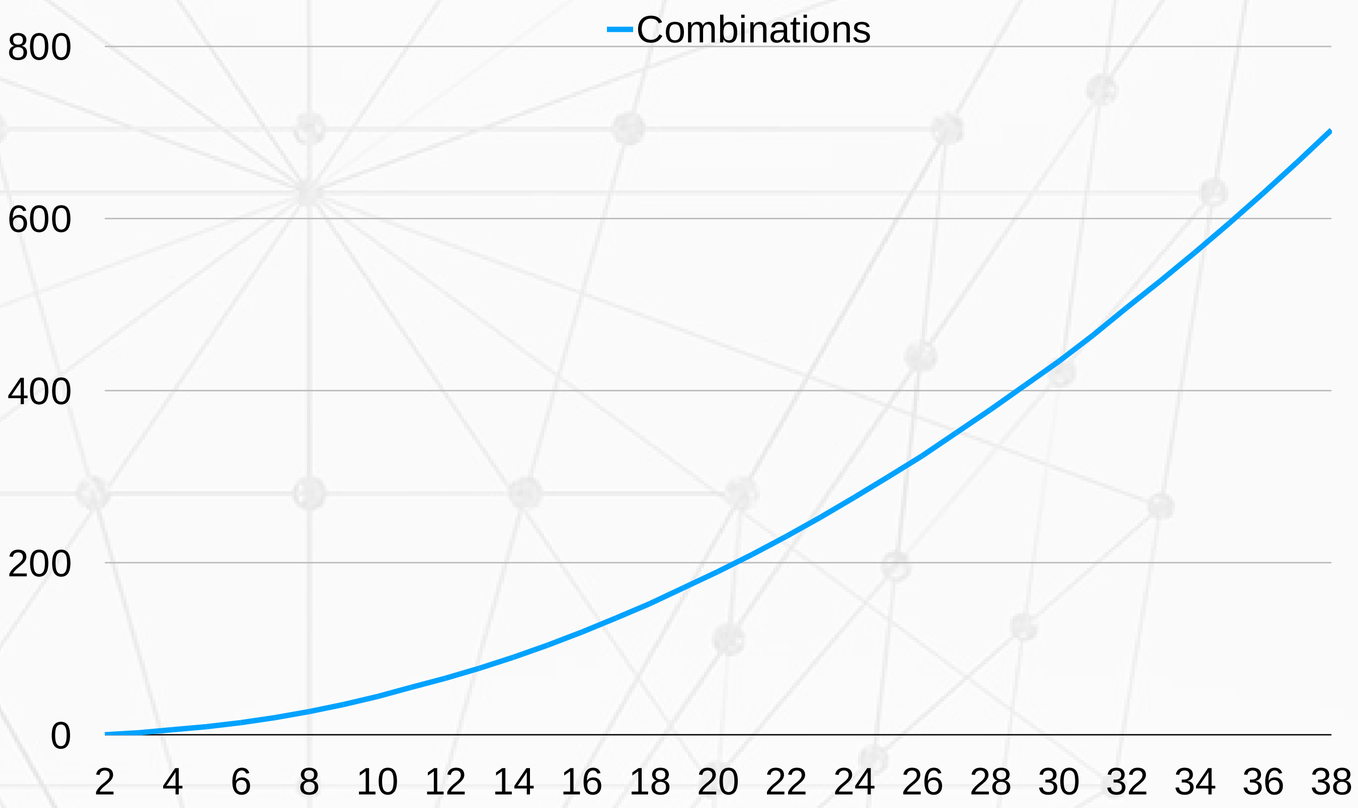
Blocking



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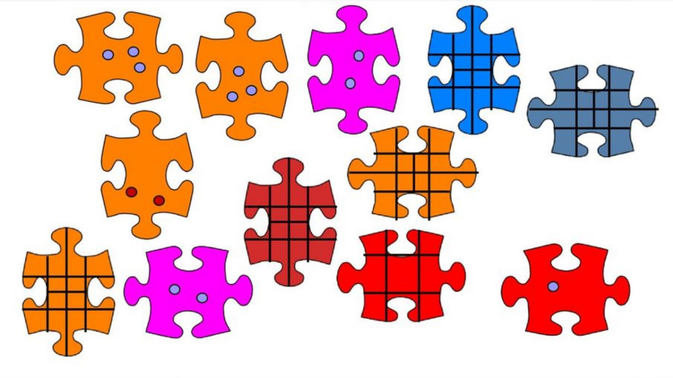
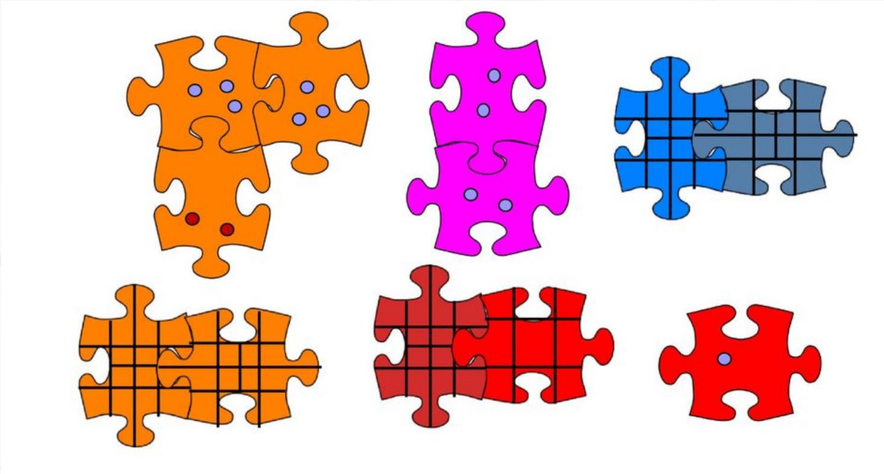
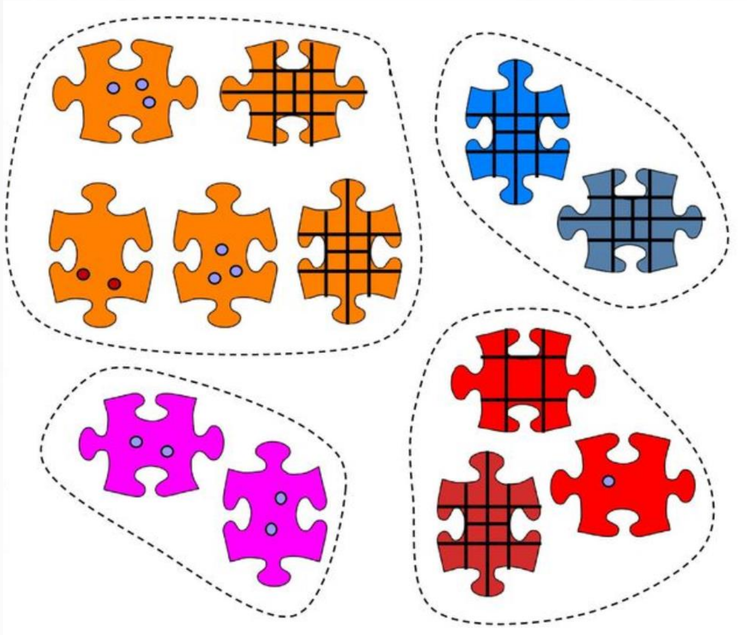
Blocking







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Similarity functions

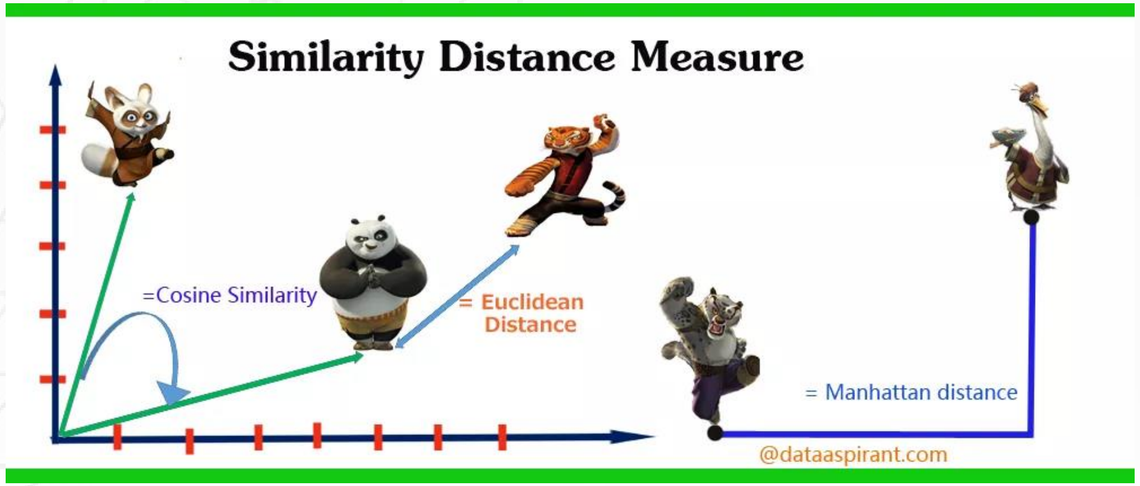
		S	a	t	u	r	d	a	y
	0	1	2	3	4	5	6	7	8
S	1	0	1	2	3	4	5	6	7
u	2	1	1	2	2	3	4	5	6
n	3	2	2	2	3	3	4	5	6
d	4	3	3	3	3	4	3	4	5
a	5	4	3	4	4	4	4	3	4
y	6	5	4	4	5	5	5	4	3

← OPERATION #1 - Delete "a"

← OPERATION #2 - Delete "t"

↖ OPERATION #3 - Transform "r" to "n"

← 3 operations in total



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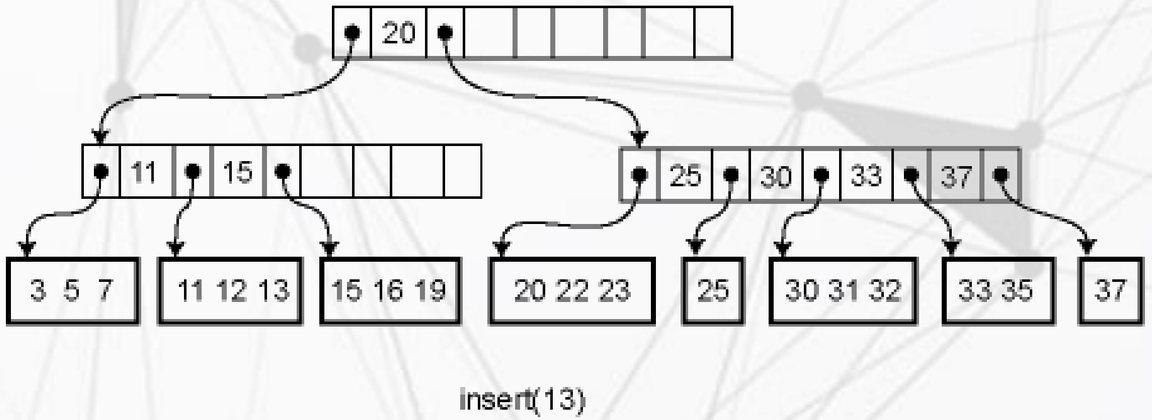
Traditional Solution

- Index based



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Pairwise Combination problem

Table 1

RecordID	Naam	Voornaam	Tel	Email	Twitter	CookieId
A	Michiels	T		tom@gmail.com	@TmMichiels	3445454
B	Michiels	T	027599608		@TmMichiels	
C	Moreau	M	027599608	t+m@gmail.com		
D	Michiels	T		t+m@gmail.com		
E	Michiels	T		t+m@gmail.com		3556565

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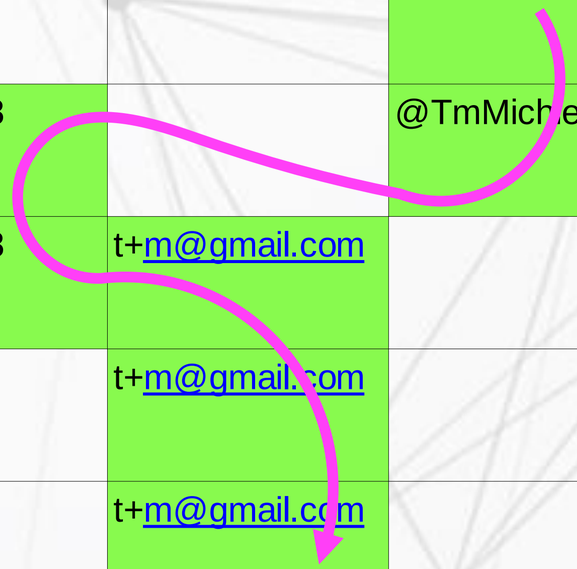

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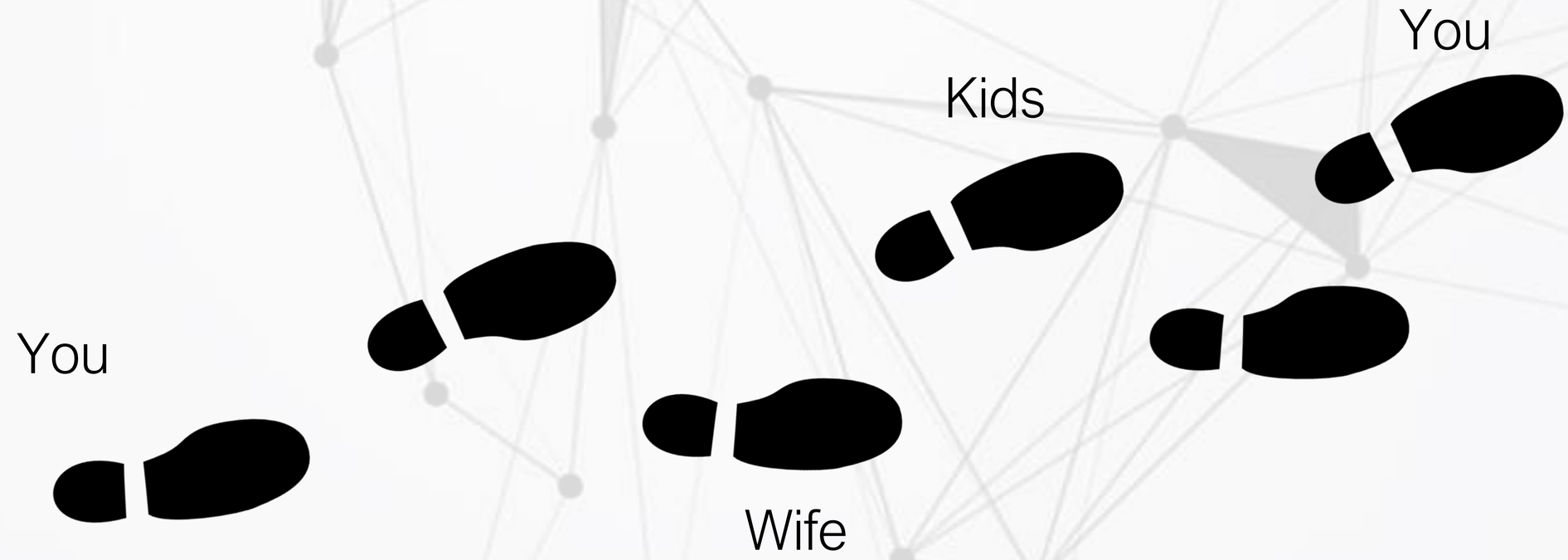
Graphs to the rescue



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Graphs to the rescue

- Graph locality
- Pointer hopping
- Graph algorithms

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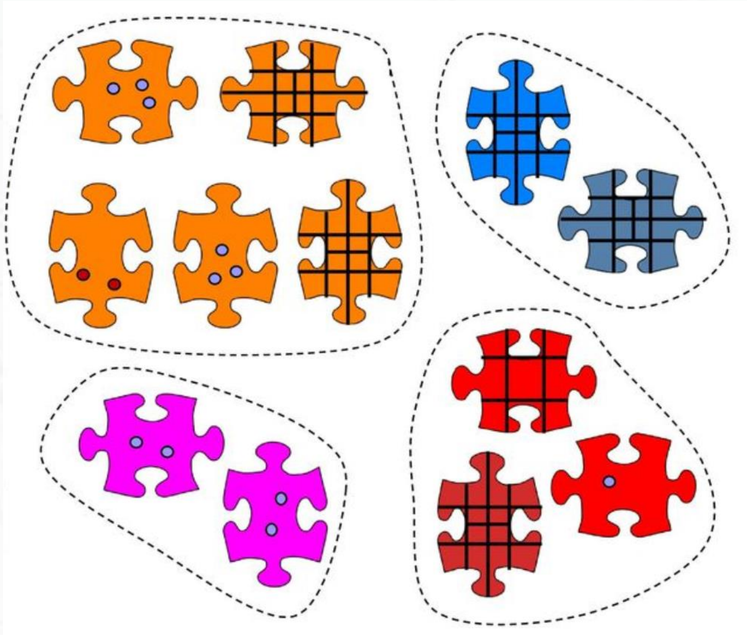
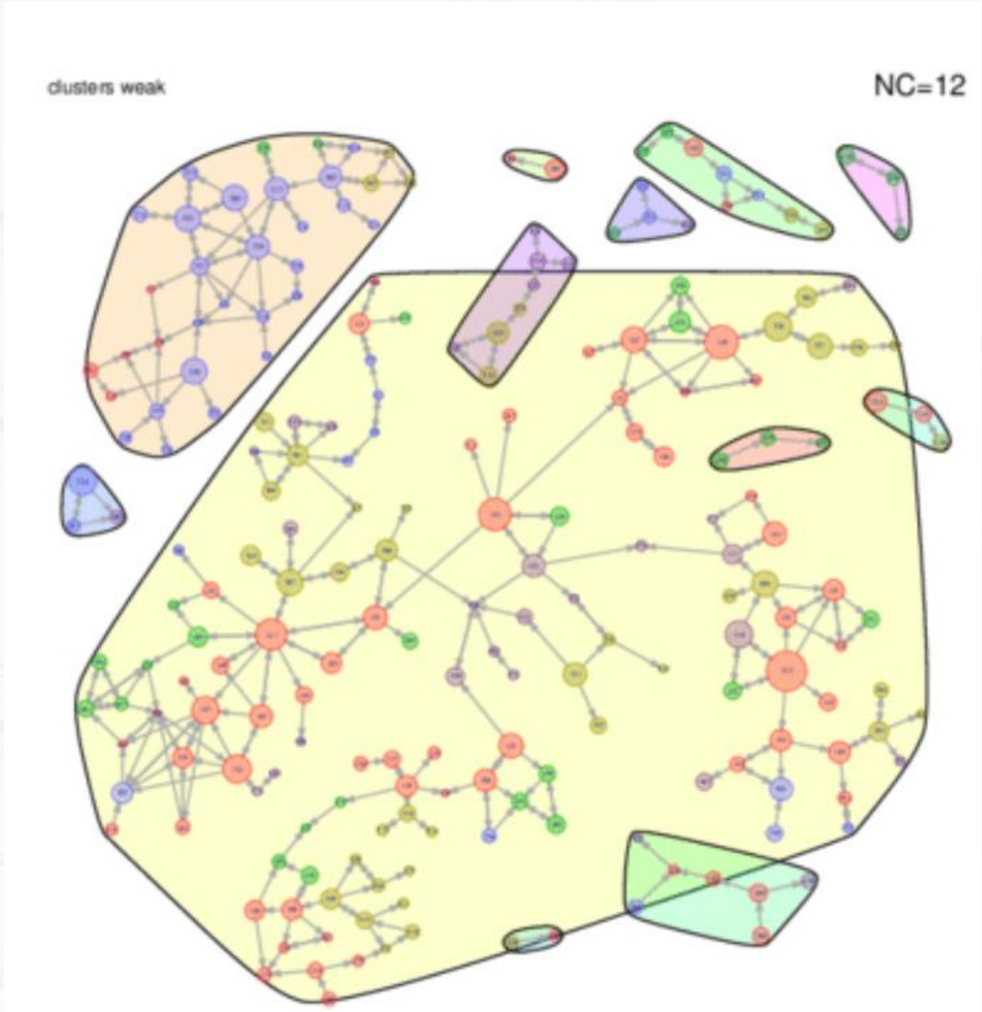
Graphs to the rescue





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Weakly connected component

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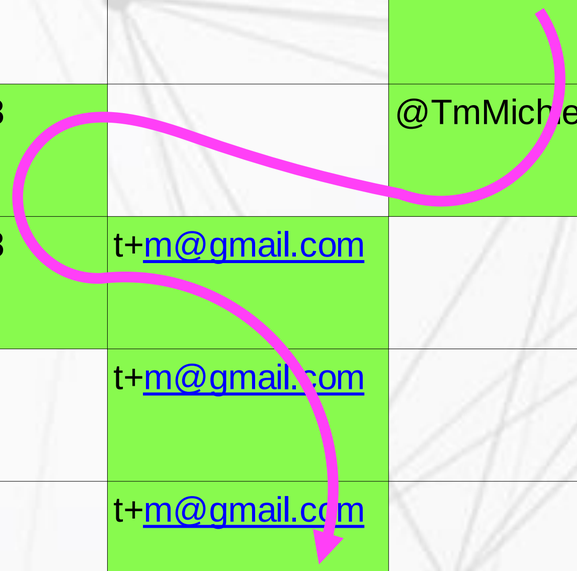

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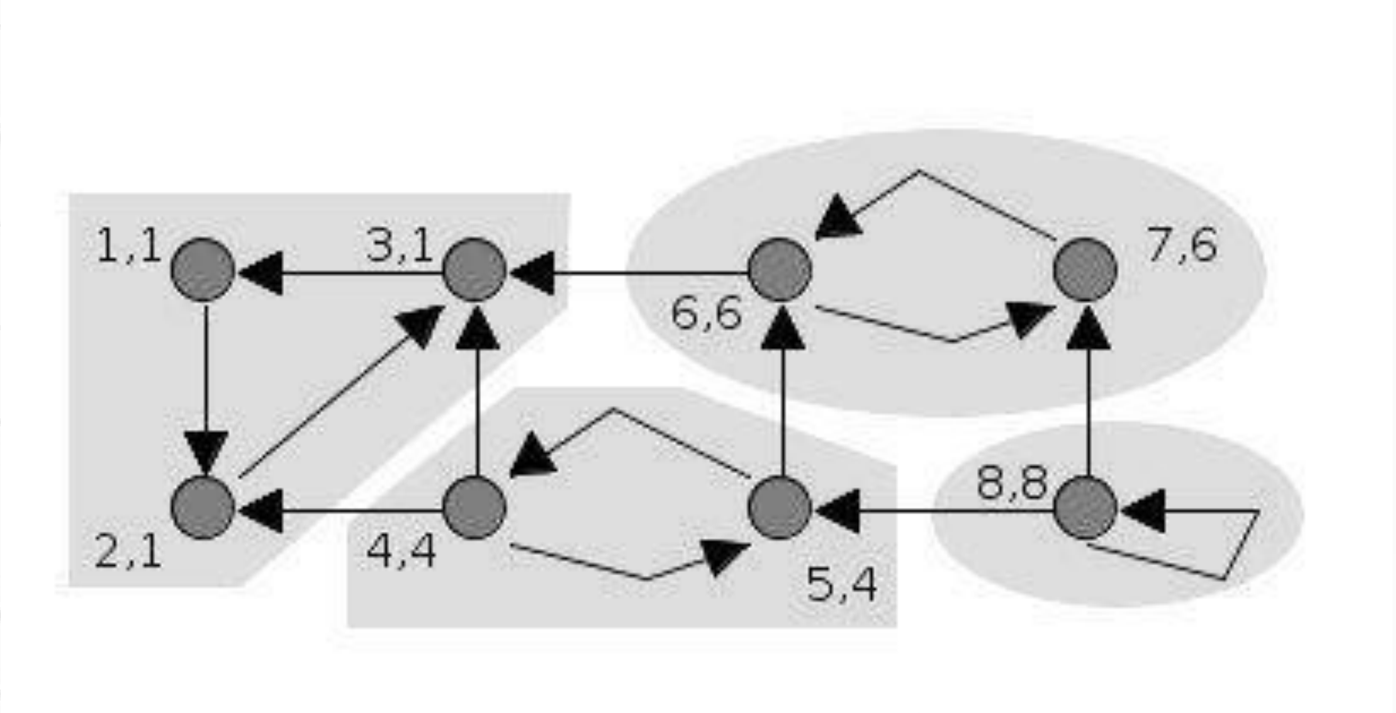
Tarjan’s connected component



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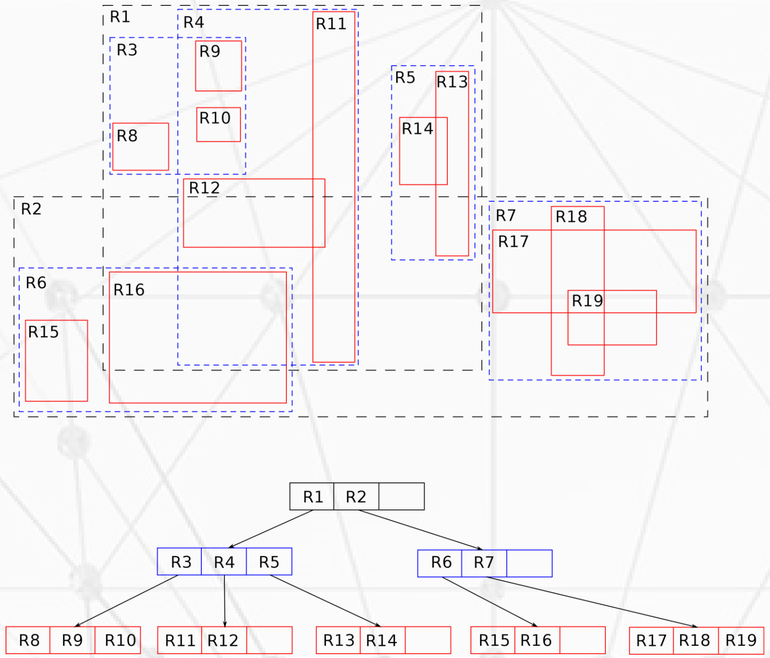
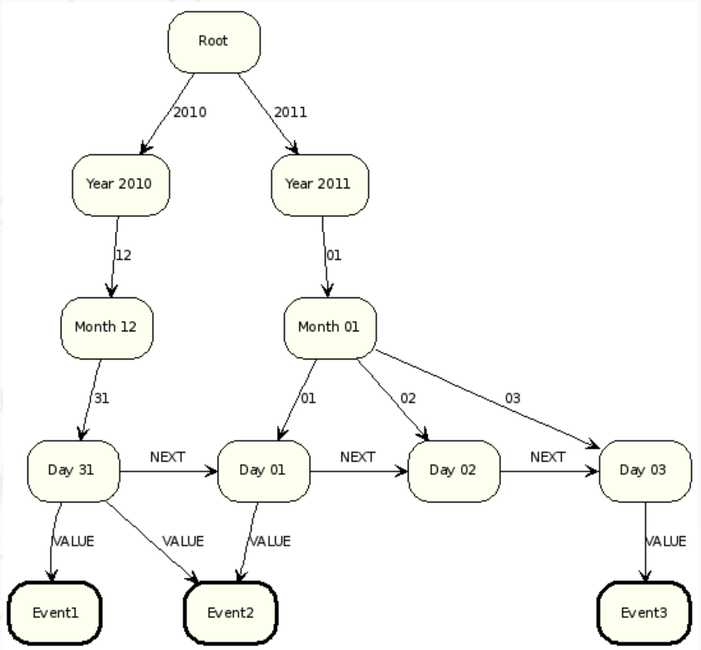
Extension - Compare in Space and Time.

R-Tree



Timetree



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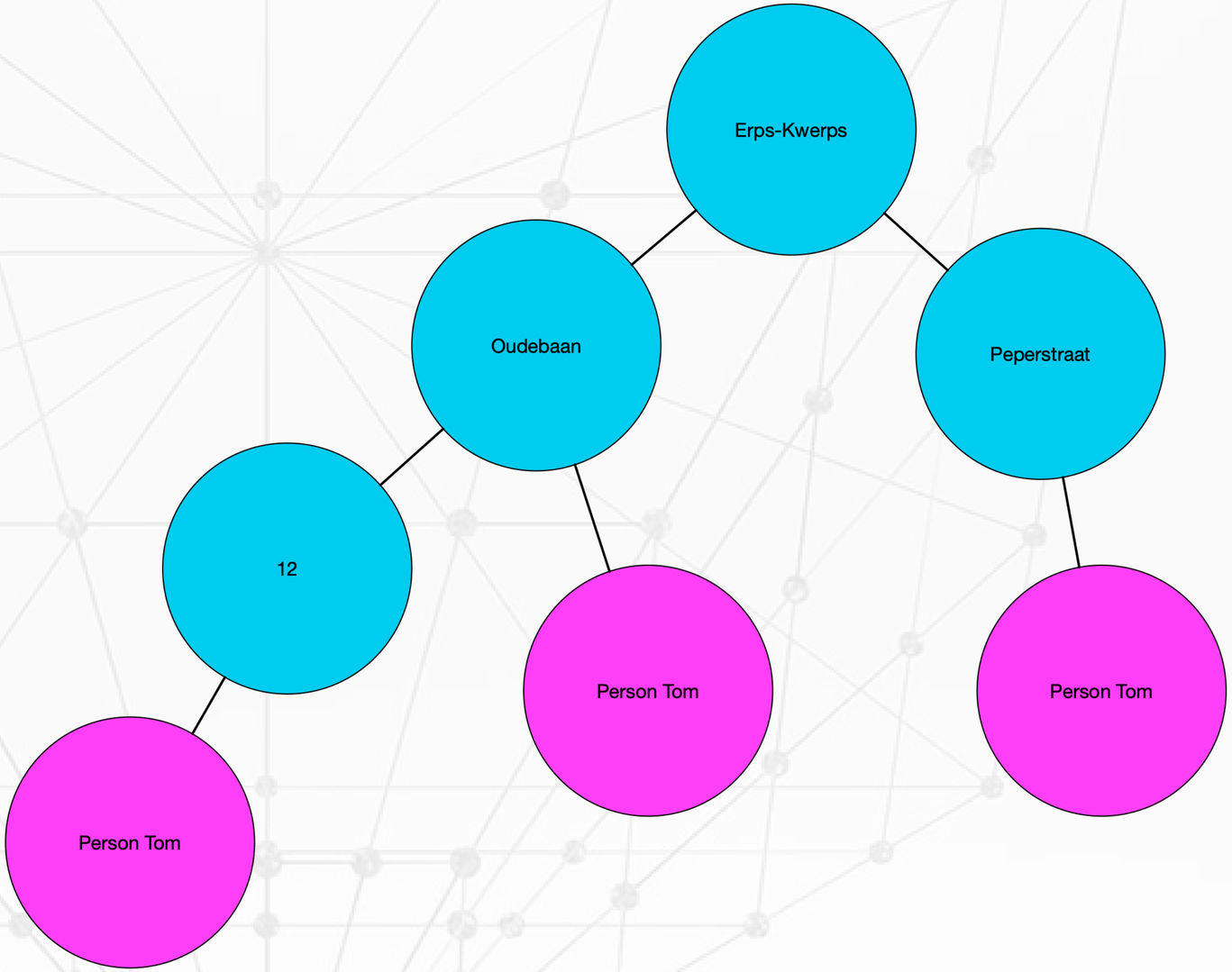
Extension - Compare in Space and Time.



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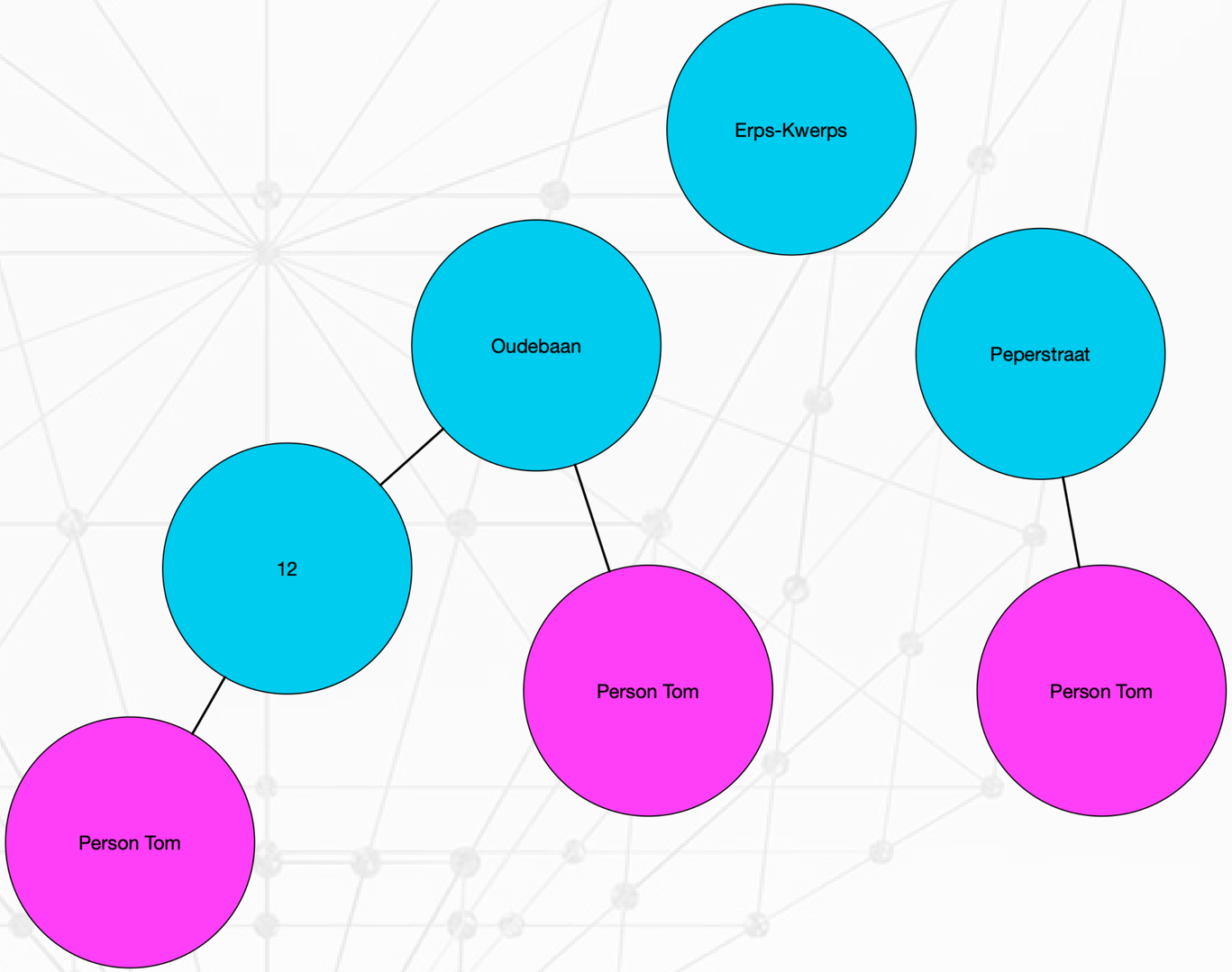
Extension - Compare in Space and Time.



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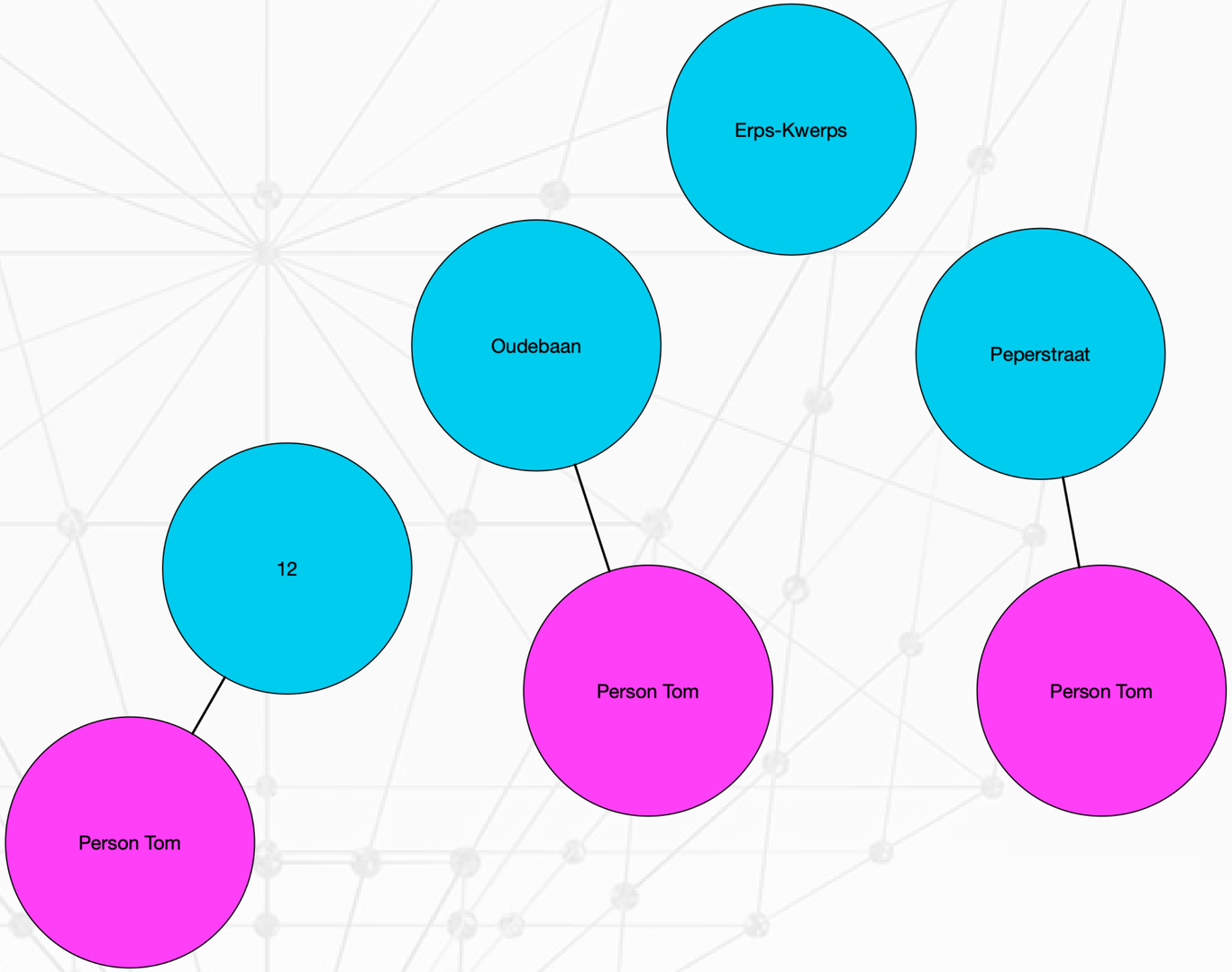
Extension - Compare in Space and Time.



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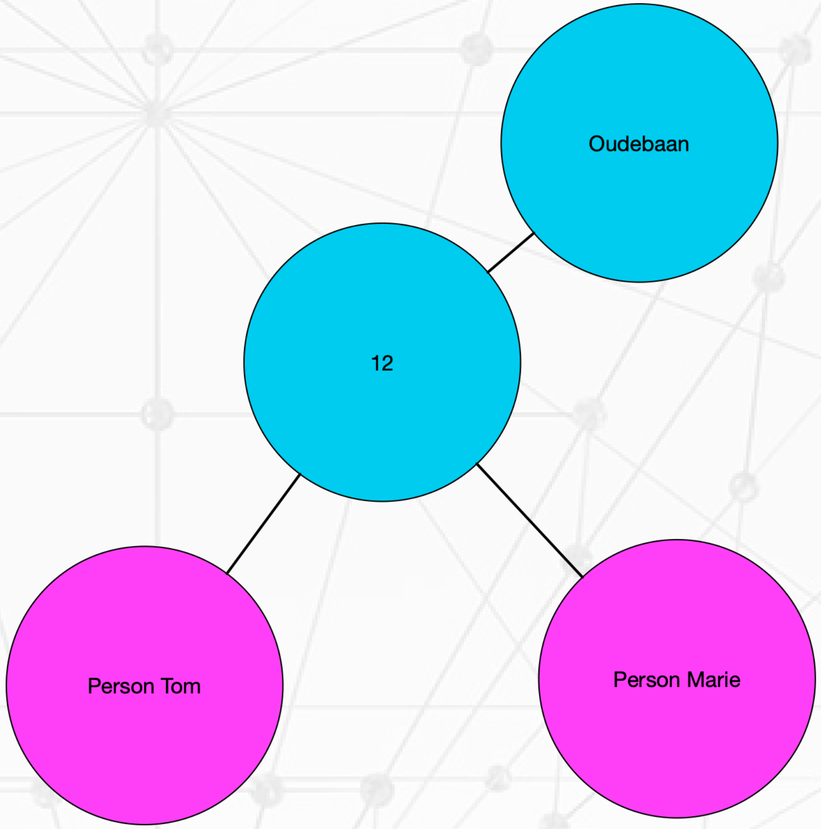
Added Value Connected Component = Household



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Advantages

- Linking through other records (Paths)
- Finding candidates through trees (Time - Location)
- Deduplication and Cluster detection is 2 step process.

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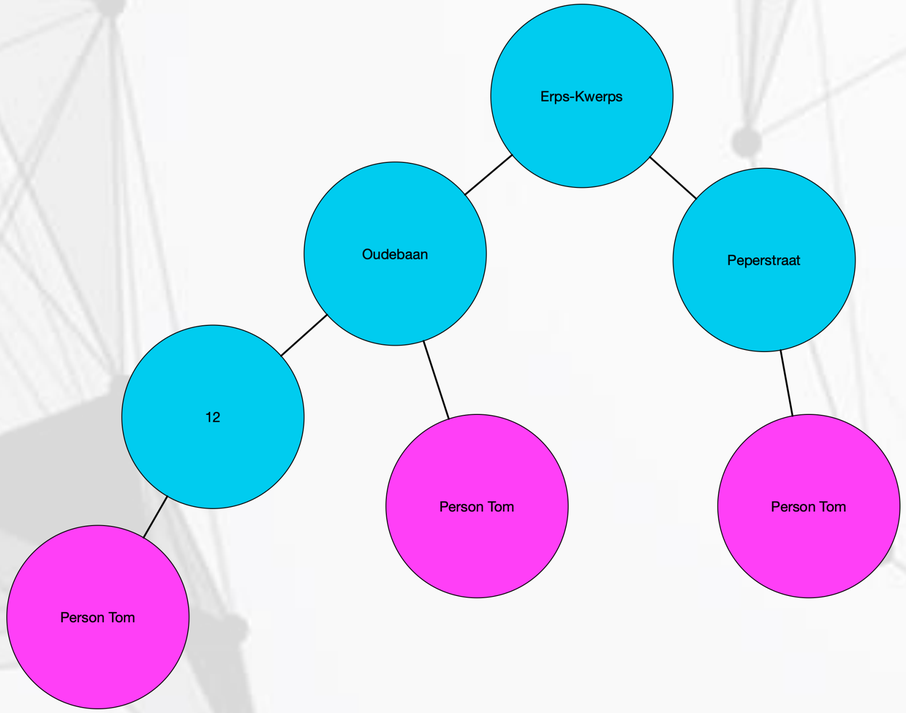
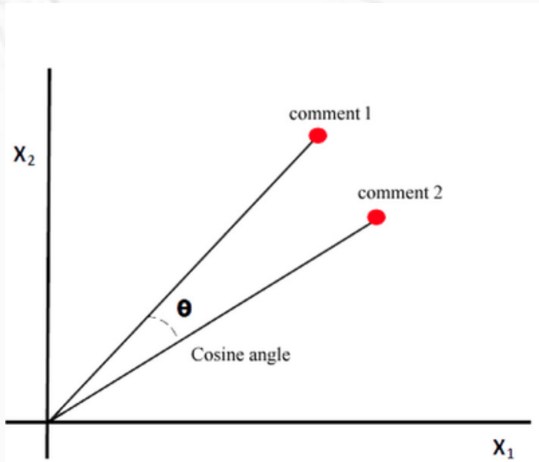
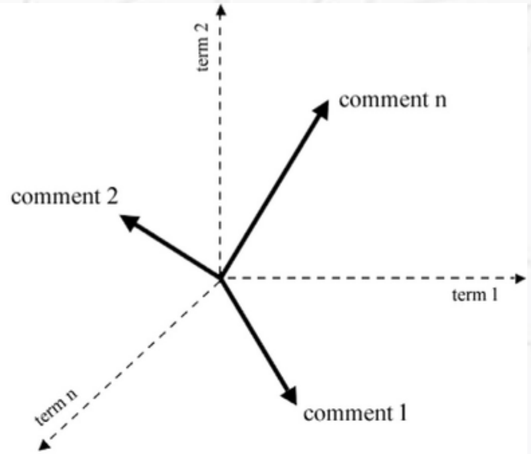
Graph2Vec





Cosine Similarity



Vector Space Model

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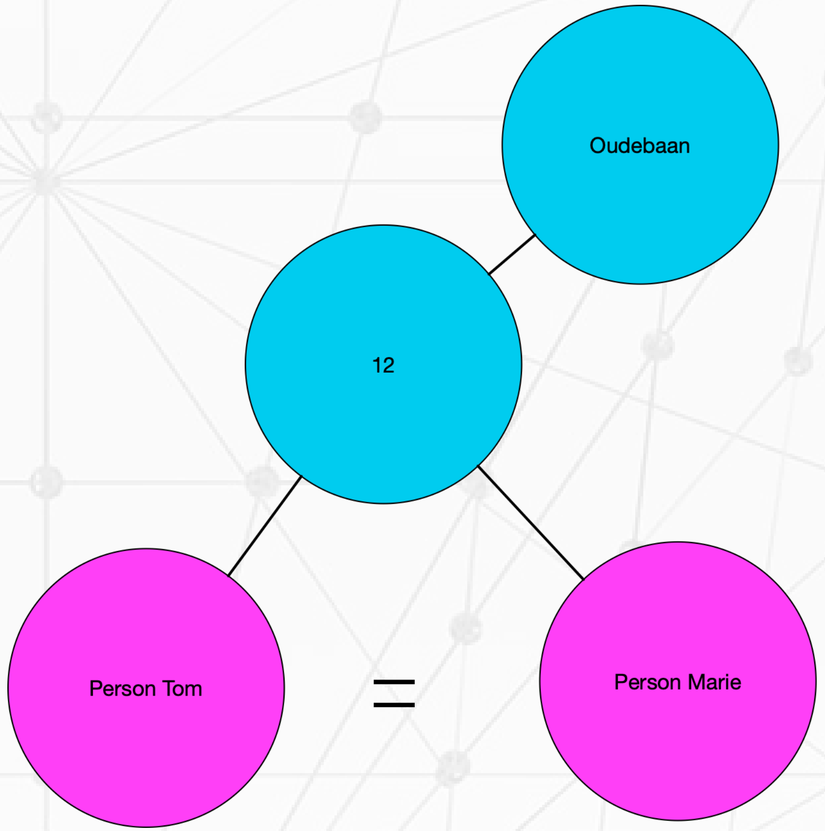
Comparison of pairs



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Comparison

RecordID	Naam Metric1	Voornaam Metric2	Naam occurence	Voornaam occurence	Match
A - B	0,6	1	0,1	0,1	True
A - C	0,8	0,9	0,1	0,1	False

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Comparison

- Rule based (Deterministic)
- Machine Learning. Active Learning, Random forests, …

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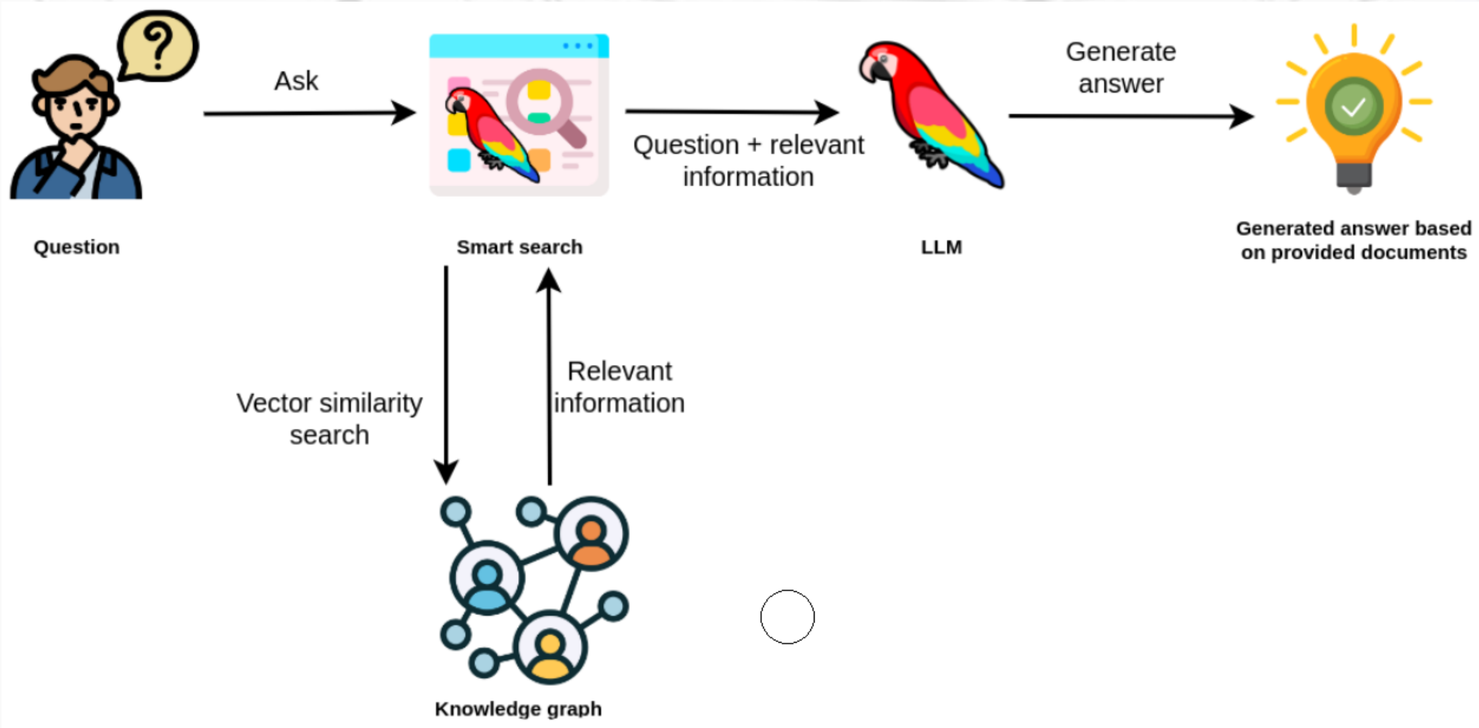
Other Possibilities

- Find Documents linked to each other by entities (Same principles as finding Pairs)



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Fraud Detection

- Find things that do not want to be found

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Conclusion

- Data Quality In improves data quality out.
- Graph algorithms can be used in other use cases like

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