

second year project bachelor artificial intelligence



TEAM PERCEPTUM

Recommending document links in the Starfish knowledge graph

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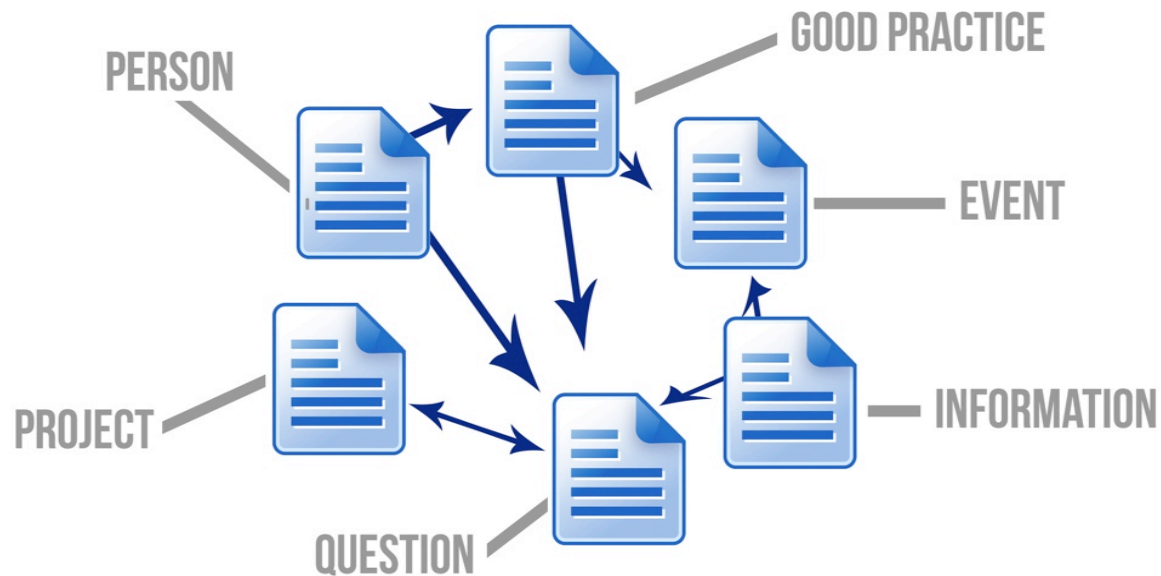
CONTENTS

- Product vision
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PRODUCT VISION

What is Starfish?

Platform for sharing knowledge on education innovation



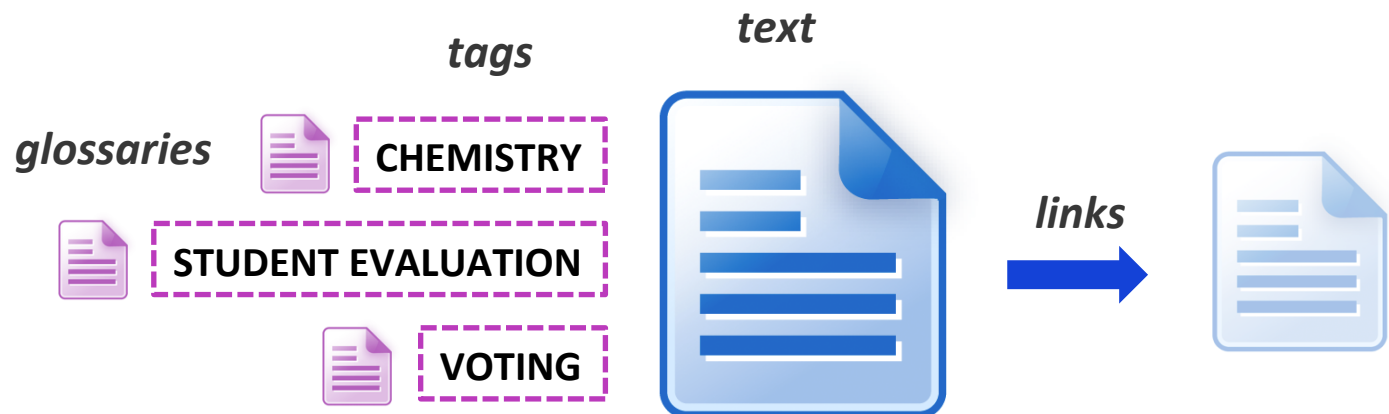
PRODUCT VISION

Product pitch

- **For** Startfish users
- **who** search for and edit knowledge in Starfish
- **the** document linker is a core system addition to StarFish
- **that** finds related documents
- **Unlike** moderated or individual/centralized linking our product uses algorithms and data to automatically suggest document links.

Relevant document properties

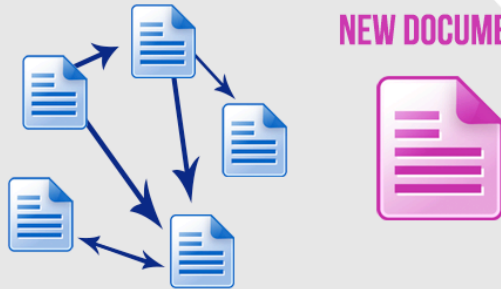
- Textual content of documents
- Tags and their glossaries
- Links to other docs



INPUT

NETWORK

NEW DOCUMENT



OUTPUT

NEW NETWORK



NETWORK DESCRIPTORS

VECTORIZER



NEW DOCUMENT DESCRIPTOR



NEAREST NEIGHBOUR

RANKING

- 1
- 2
- 3
- 4
- 5

THRESHOLD

PROPOSED

- 1
- 2
- 3
- 4
- 5

USER SELECTION

VECTORIZER



[
0.003
0.000
:
0.901
0.100
]

➤ **TEXT BASED:** bag of words and TF-IDF

1. Textvectorizer
2. Weighted textvectorizer

➤ **TAG BASED:** occurrences and co-occurrences of tags

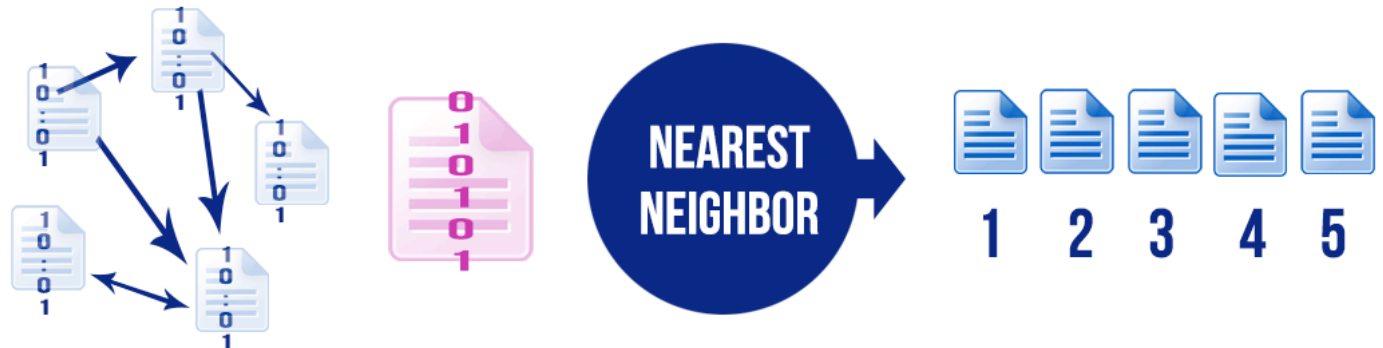
1. Simple tag vectorizer
2. Tag smoothing vectorizer

➤ **HYBRID:** TF-IDF of glossaries of tags

1. Glossaries of tags
2. Weighted glossaries of tags

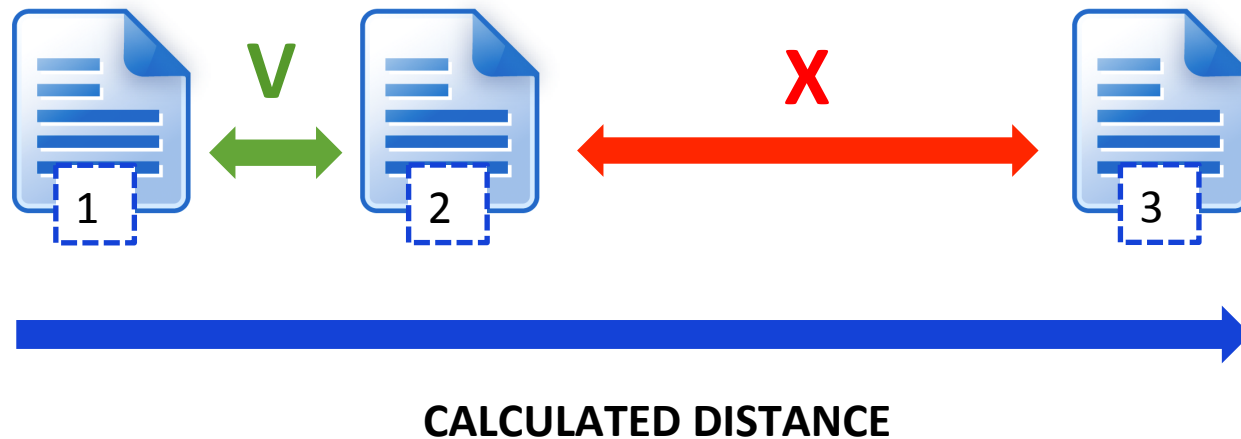
K-NEAREST NEIGHBOR

- Calculate **distance** between descriptor of new document and descriptor of the knowledge base
 1. Cosine
 2. Correlation
- **Rank** documents based on their distances



THRESHOLD

Cut off the number of returned documents based on the **difference between distances** of two consecutive ranks



EVALUATION METRICS

➤ **WITHOUT THRESHOLD:** system returns same amount of links as the document is known to have
Accuracy: correct docs / relevant docs

➤ **WITH THRESHOLD:**

Precision: correct docs / returned docs
User friendliness

Recall: correct docs / relevant docs
Knowledge base coverage

VECTORIZER PERFORMANCE



BEST PER VECTORIZER BIG TABLE

VECTORIZER PERFORMANCE

➤ TEXT BASED

- + 40.70% accuracy on Questions
- Relatively slow
- Only applicable to textual content
- Bad at handling language differences

➤ TAG BASED:

- + 35.31% accuracy overall document types
- 16.67 % accuracy on Questions
- Bad performance on no or badly labeled tags

EVALUATION THRESHOLD



BEST PER VECTORIZER BIG TABLE

BEST PER VECTORIZER THRESHOLDS

EVALUATION THRESHOLD

- **COMPARED WITH ACCURACY ON FIXED LINKS:**
 - + Higher precision/recall if tag-based/hybrid
 - Lower recall and precision of text-based

DEMONSTRATION

CONCLUSIONS

- Use *weighted text vectorizer* for Questions
- Use *simple tag vectorizer* for the rest
- Overall performance of entire pipeline:
 - **Precision:** 50.93% of the recommendations make sense
 - **Recall:** 49.72% of the relevant documents in the knowledge base are shown

ACKNOWLEDGEMENTS

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QUESTIONS?

Feel free to ask us!