VECTORIZATION OF DOCUMENTS AND ANALYSIS OF THEIR IDENTITY USING A NEURAL NETWORK

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Purposes and objectives

Purposes

Created by Garrett Knoll
from Noun Project

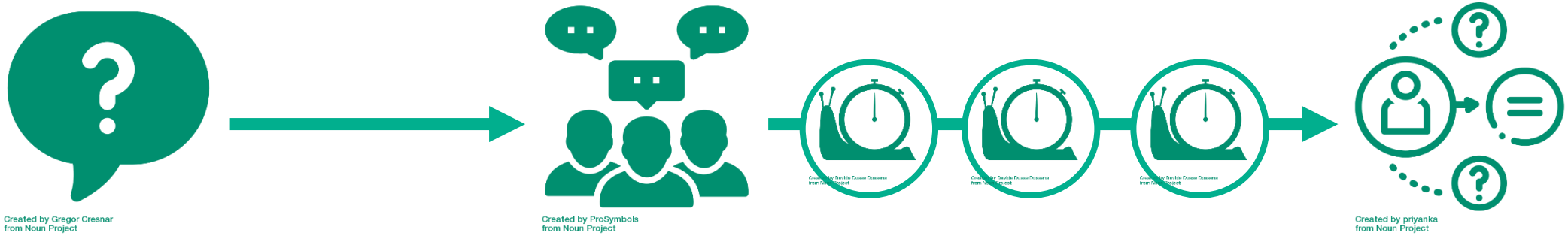
The purpose of this article is to design a convenient and fast system for searching for similar documents.

Objectives

Created by Alice Design
from Noun Project

- Text processing.
- Studying the theory of word embedding.
- Designing an algorithm to determine the optimal model parameters.
- Model development.
- Application of the model in practice.
- Discussion of the results of the designed model.

Relevance



Question

The user wrote a question

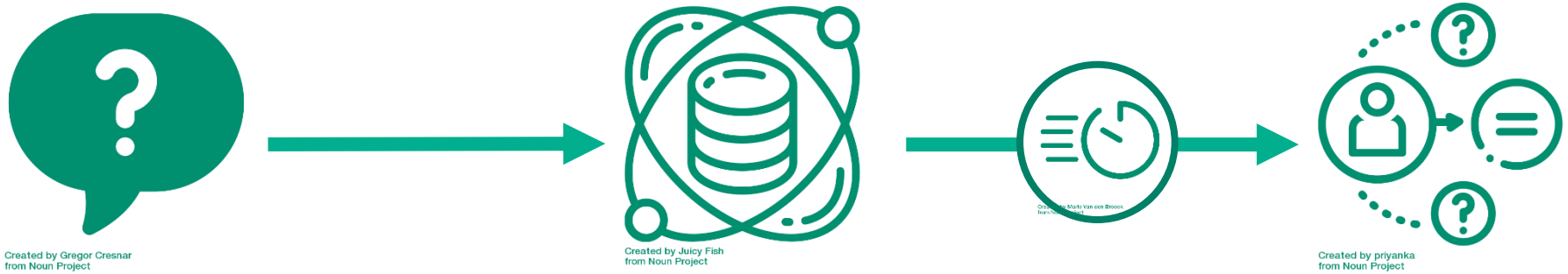
Forum

Living people are on the forum

Answer

Answers appear after a while

After



Question

The user wrote a question

My system

The system analyzes the text of the question

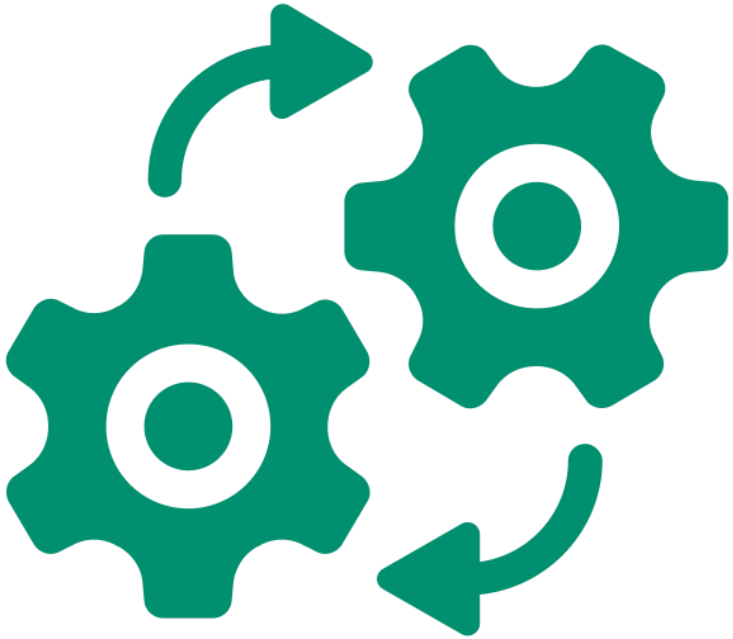
Question

The system offers similar questions

Before

Solution

Plan



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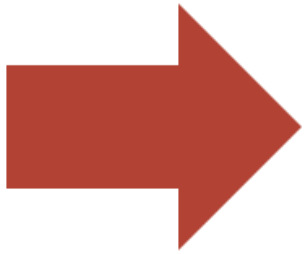
from Noun Project

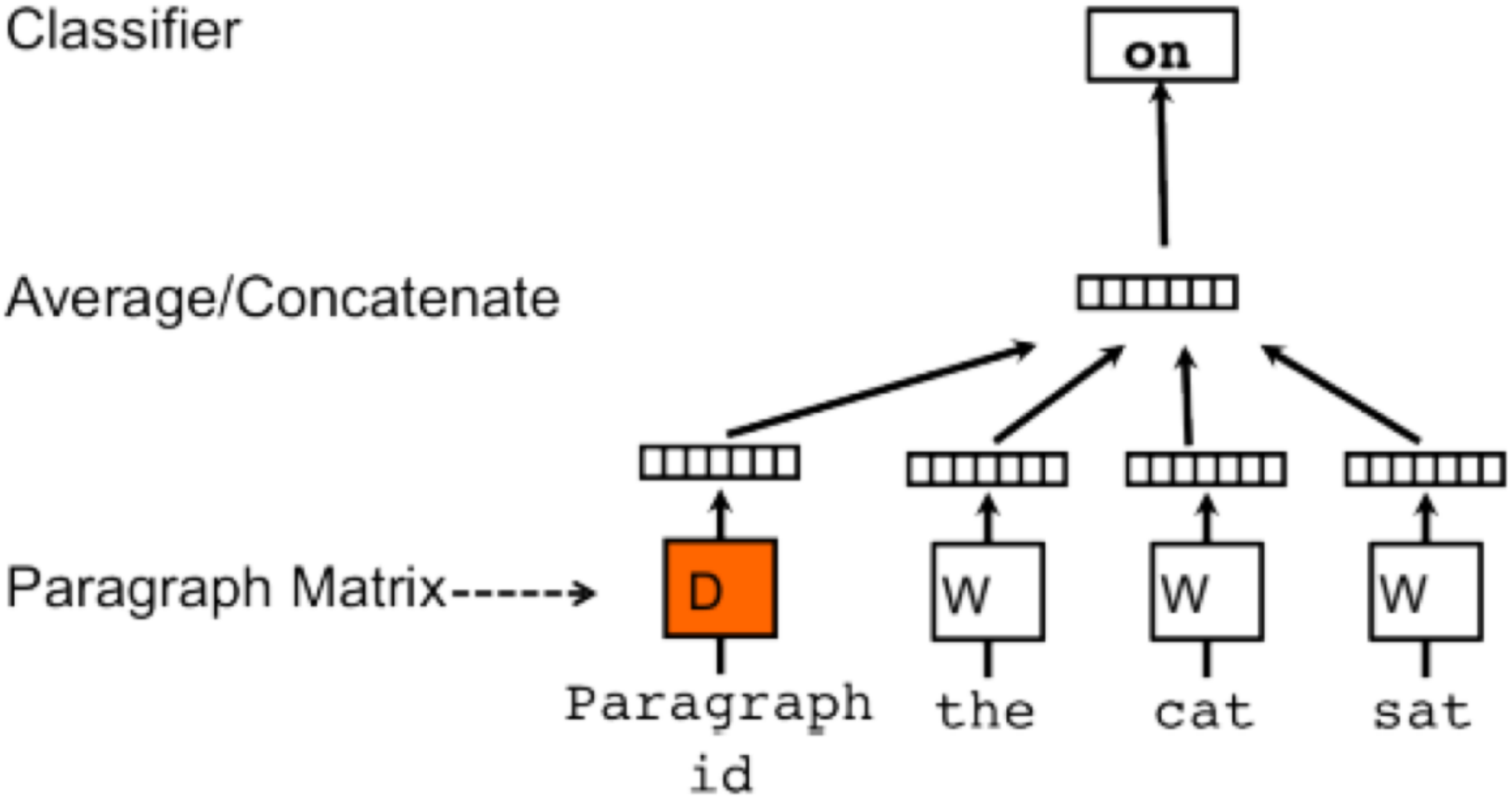
- Text processing (tokenization, stemming, removal of stop words)
- Creating a model architecture based on the doc2vec neural network to select the optimal parameters
- Determining the Best Quality Metrics
- Implementation on the website
- Model training every n days
- Using the model on new data

Vocabulary:
Man, woman, boy, girl, prince, princess, queen, king, monarch

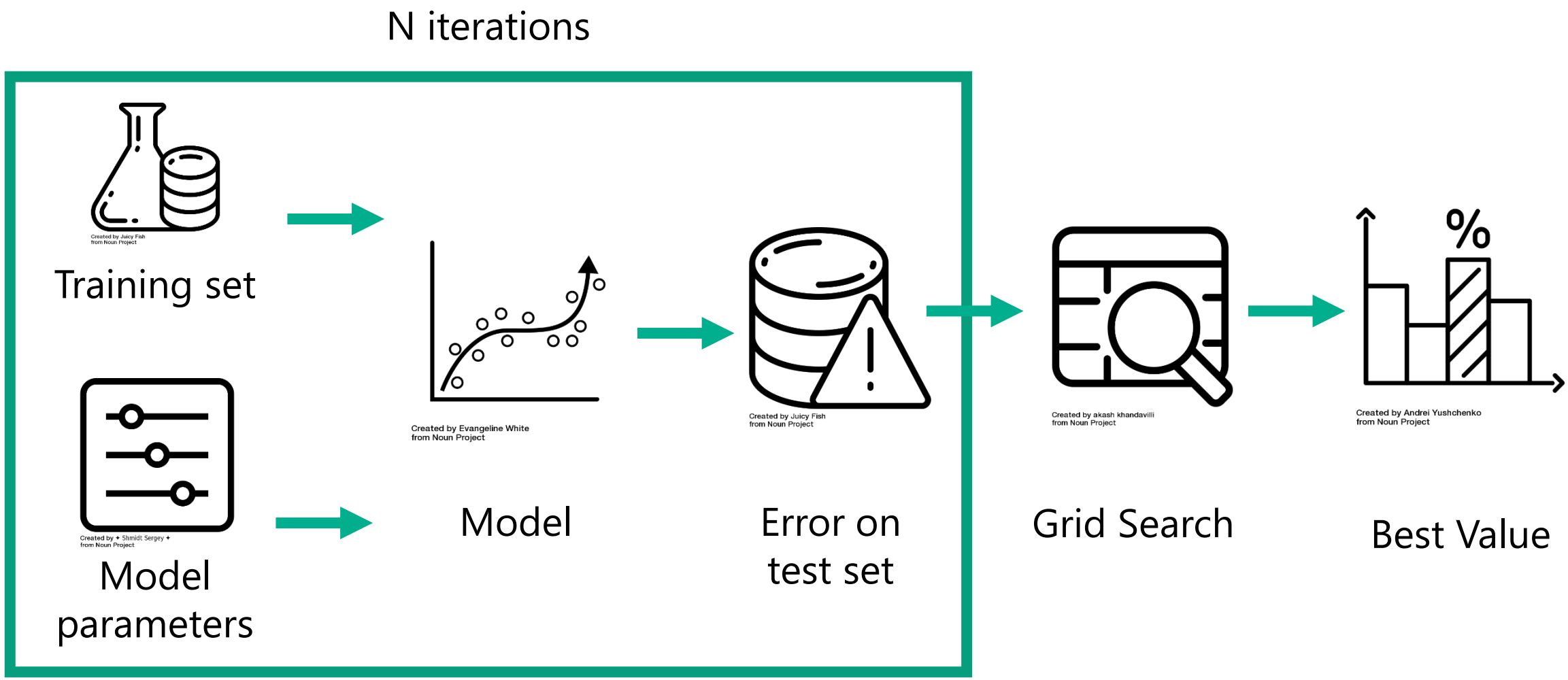


	1	2	3	4	5	6	7	8	9
man	1	0	0	0	0	0	0	0	0
woman	0	1	0	0	0	0	0	0	0
boy	0	0	1	0	0	0	0	0	0
girl	0	0	0	1	0	0	0	0	0
prince	0	0	0	0	1	0	0	0	0
princess	0	0	0	0	0	1	0	0	0
queen	0	0	0	0	0	0	1	0	0
king	0	0	0	0	0	0	0	1	0
monarch	0	0	0	0	0	0	0	0	1

word2vec. Word embedding



Doc2vec architecture



System architecture

Quality metric

Created by Eucalyp
from Noun Project

Arithmetic average precision

$$AP@k(q) = \frac{\sum_{i=1}^{k} Precision@k(q)}{k}$$

$$Precision@k(q) = \frac{1}{k}\sum_{i=1}^{k} y(q, d_q^i)$$

Used tools

Created by Danil Polshin
from Noun Project

numpy is a library for convenient work with arrays.

pandas is library for working with data frames.

sklearn is library containing various classification, regression, clustering, downsizing algorithms using t-SNE.

nltk is a package of libraries and programs for symbolic and statistical processing of a natural language.

pymystem3 is a library for lemmatizing tokens of the Russian language.

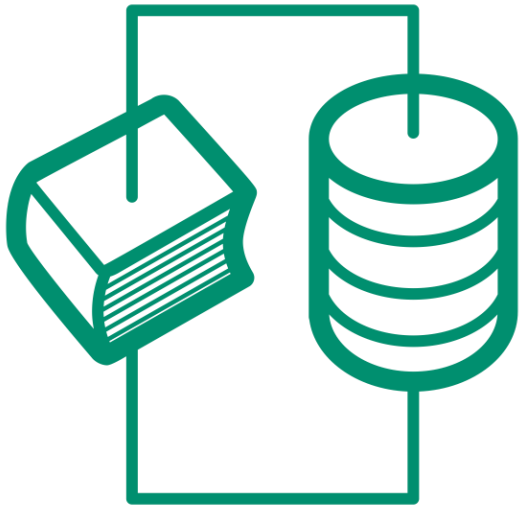
scipy is a library for performing scientific and engineering calculations.

matplotlib is a library for multidimensional data.

genism is a library containing the implementation of doc2vec.

Data sets

Дата сеты



Created by H Alberto Gongora
from Noun Project

Toy set

- 70 documents
- Each document contains 3-5 words
- 3 classes
- 300 words

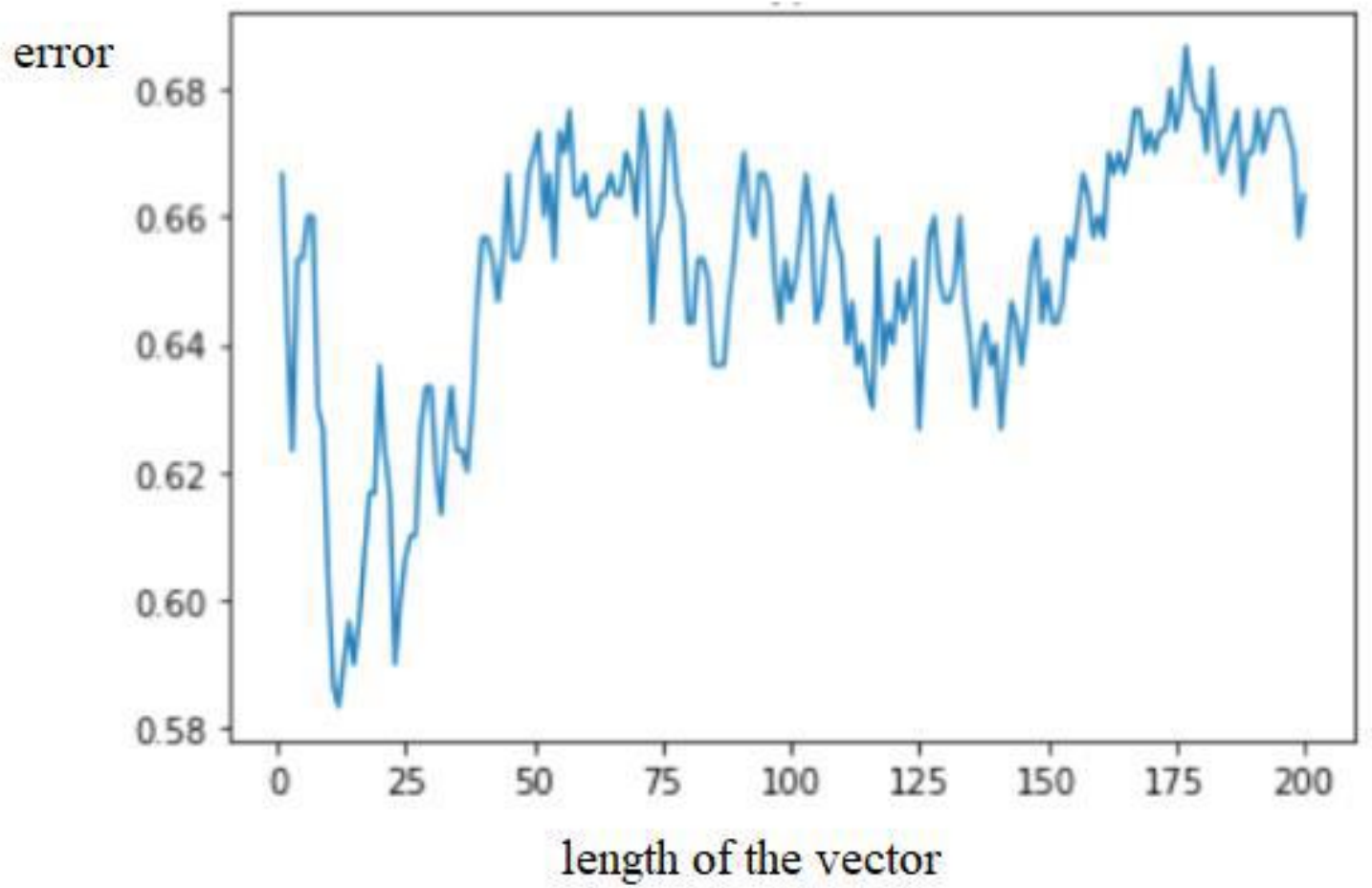
Books

- 700 documents
- Each document contains 100 thousand words
- 8 classes
- 75 million words

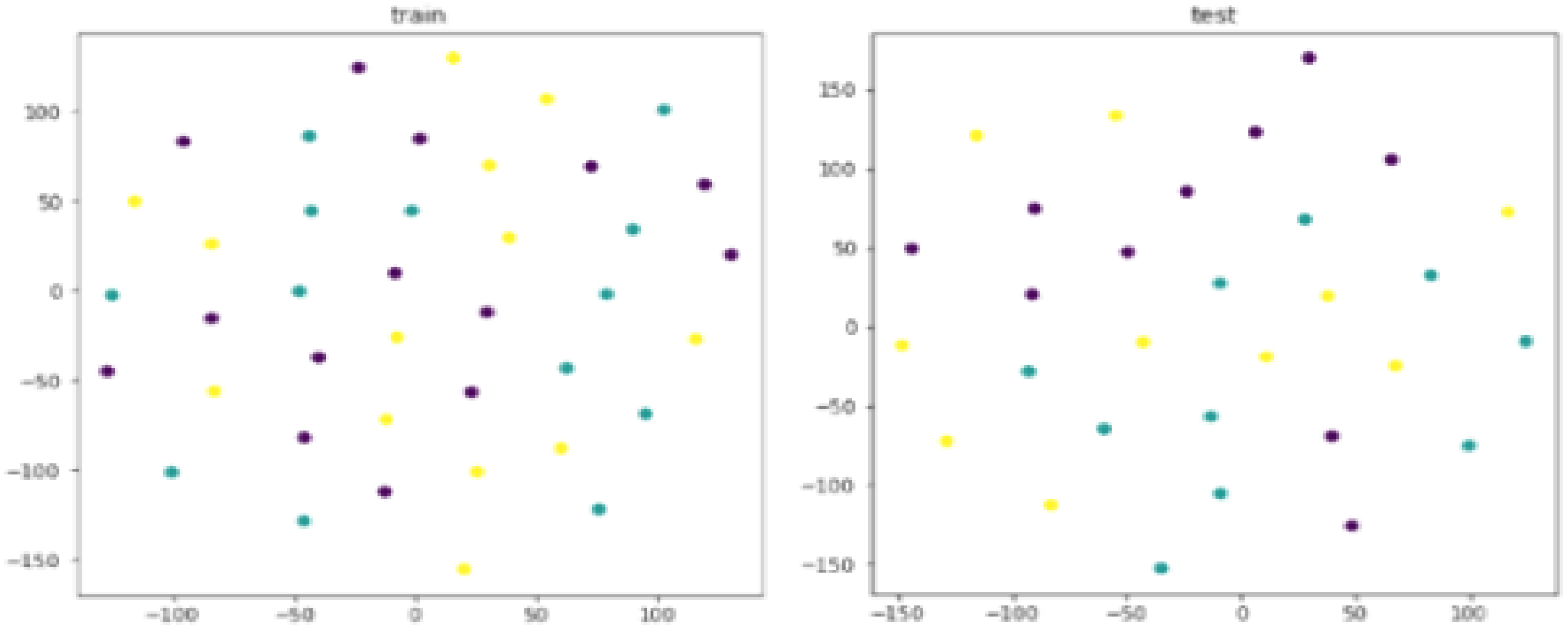
News

- 600 thousand documents
- Each document contains 300 words
- 20 classes
- 120 million words

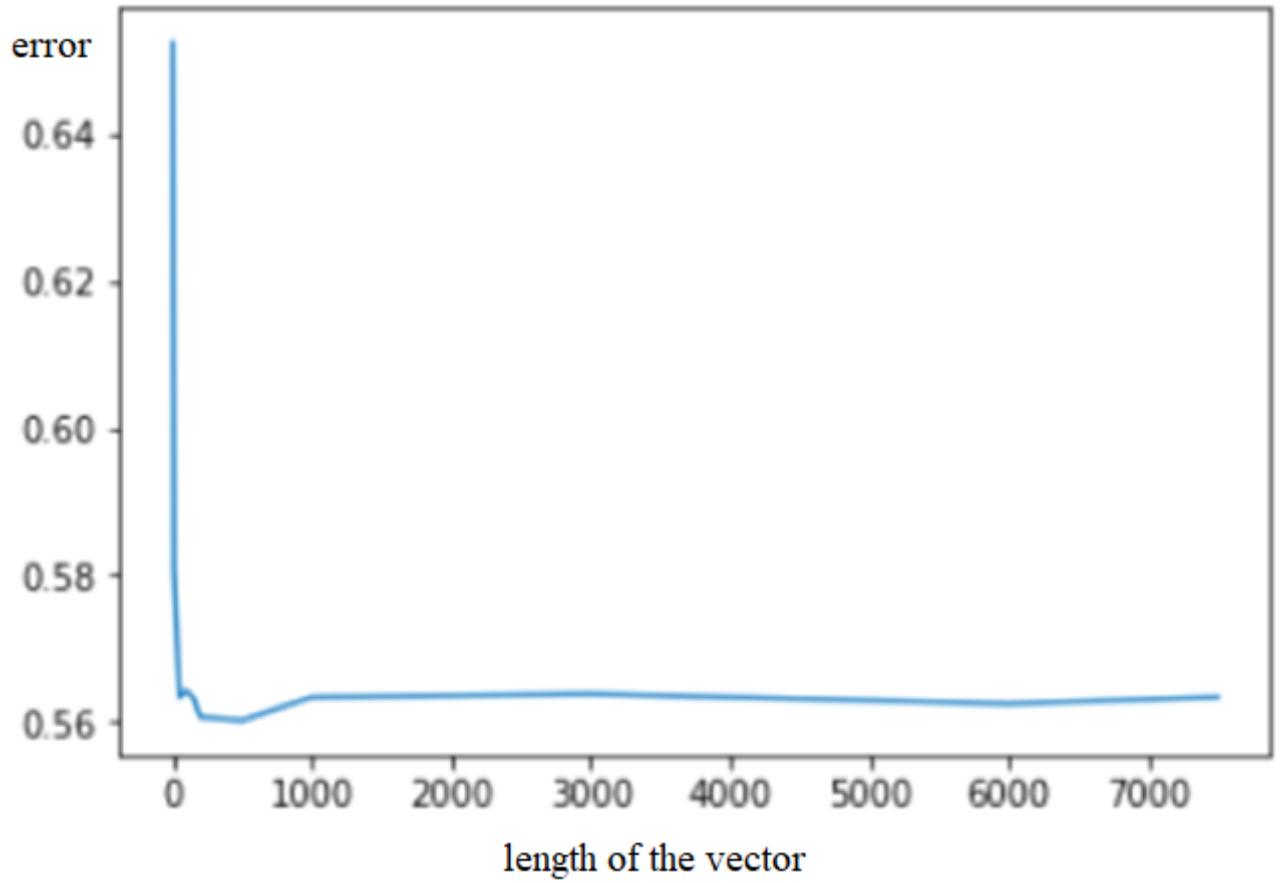
Results



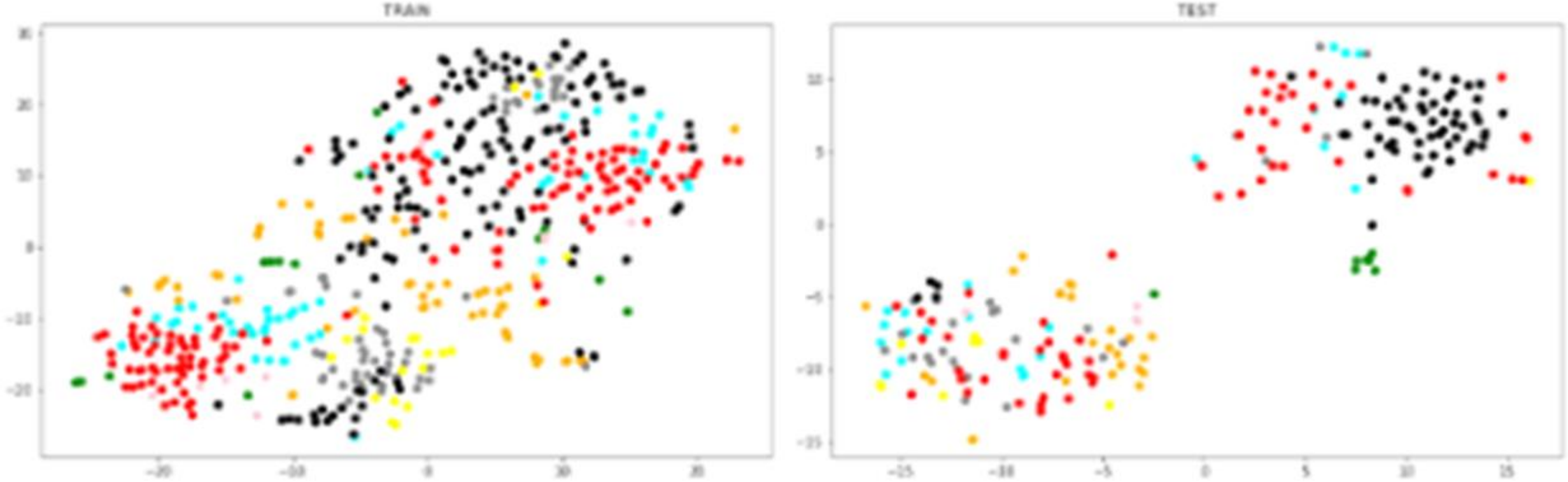
Toy set. Dependence of the error on the length of the vector



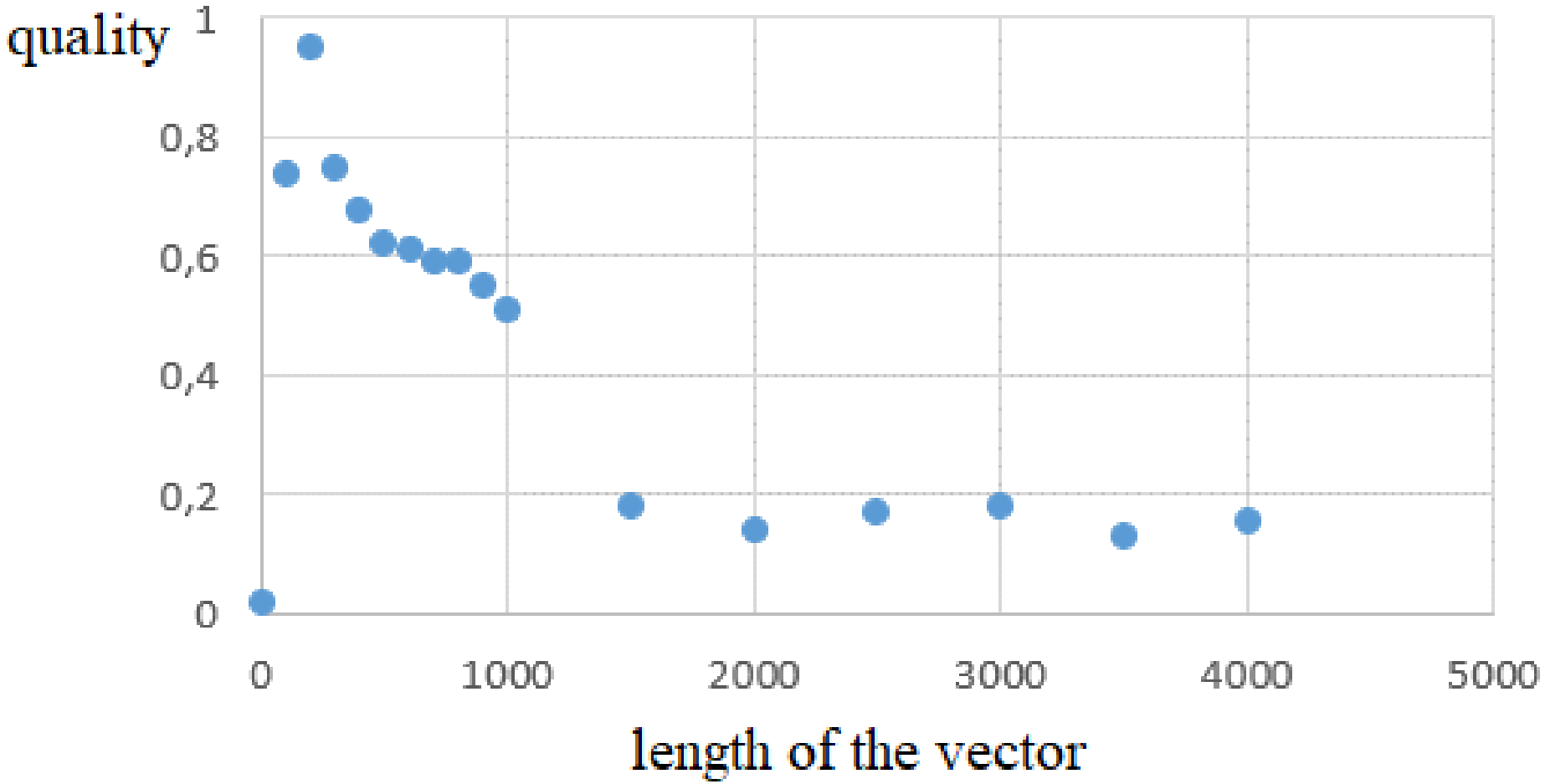
Toy set. Visualization graphs on the train and test data sets



Books. Dependence of the error on the length of the vector



Books. Visualization graphs on the train and test data sets



News. Dependence of the quality on the length of the vector

Conclusion

Summary

Created by Adrien Coquet
from Noun Project

- all classes should be present in the training and test data sets.
- the algorithm does not work correctly on a small text corpus.
- train and test data sets should be large enough for the quality of the model to be good.
- vector representation allows to determine the hidden (latent) meaning of texts based on the occurrence of words with each other. This technique gave an accuracy of about 90% when searching for similar news.
- the error decreases sharply, reaches its global minimum, slowly grows or remains at the same level.