

# The Implementation of K-Means Clustering Method in Classifying Undergraduate Thesis Titles

Lisna Zahrotun<sup>1</sup>, Nila Hutami Putri<sup>2</sup>, Arfiani Nur Khusna<sup>3</sup>

*Informatics Engineering Study Program*

*Ahmad Dahlan University*

Yogyakarta, Indonesia

lisna.zahrotun@tif.uad.ac.id<sup>1</sup>, nila.hutami12@gmail.com<sup>2</sup>, arfi.khusna@tif.uad.ac.id<sup>3</sup>

**Abstract**—One of graduation requirements at university is completing undergraduate thesis. At Industrial Engineering Universitas Ahmad Dahlan, undergraduate thesis titles are documented by thesis coordinator. The problem is that students are less knowledgeable on thesis topics, so they do not really know the previous students' thesis topics. Based on the problem, this research aims at developing a program to classify thesis title so the knowledge on the trend of thesis title topic can be got. The method used in this research was K-Means clustering, while range measurement method used was cosine similarity. The testing used Silhouette Coefficient method. The phases from text mining were tokenizing, filtering, stemming, similarity, classifying, testing. The result of this research is a program that can process the title data into trend group pattern of thesis title topic.

From 138 data obtained, there are three clusters arranged based on the field on Industrial Engineering study program. Silhouette Coefficient testing shows score of 0.5674 that shows the clustering result is classified low. It occurs since the textual data of the thesis title is too widely distributed, so the title has relatively low similarity score

**Keywords**— *thesis title, cosine similarity, k-means, clustering, text mining*

## I. INTRODUCTION

The knowledge on the trend of undergraduate students' thesis topic at university generally and study program specifically can positively give benefits for both curriculum development and roadmap planning for institution scaled research. However, technology to quickly get overall information from the result of students' thesis is really limited if compared to the available storing technology. Another problem found at university is the automatic thesis title clustering process as at Industrial Engineering Study Program Universitas Ahmad Dahlan that had never carried out thesis clustering. All this time, Industrial Engineering had not had documented data that showed the trend of thesis title at every year. Whereas, approximately 50 students of this study program graduate every year. It means there were about 50 undergraduate thesis titles produced at this study program every year. As a result the thesis title data was only there on the coordinator in excel file format and had not been published. If those thesis titles were classified, it can ease in giving reference for students in taking thesis title topic.

One of techniques used in managing document in text format is text mining. The scope of text mining involves clustering, classification, dimension reduction, topic modeling, and similarity computing [1]. Several researches related to text mining which have been conducted were similarity analysis on clustering by using shared nearest neighbor (SNN) method [2]. The use of K-Means method is also in clustering document in text format [3]. In addition, K-Means method is one of ten best data mining algorithm [4]. Another application is text mining for Arabic alphabet [5]. Review of 50 years clustering K-means [6]. and Text document clustering by using SNN method [7]. Exploring clustering methods in classifying data in text format and An experimental result from S. Jaiganesh (2015) proved that the cosine measure is the best comparability measure for the k-means calculation [8]. K means clustering algorithm is an algorithm that is sensitive to outliers [8].

From the existed problem and the ability of K means algorithm to group text data, trend clustering on thesis titles is done by using K-Means Clustering with Cosine Similarity. It is expected that this research can classify the thesis title into trend group pattern of thesis topic as consideration in giving reference to students and curriculum development.

## II. RESEARCH METHOD

### A. Research Data

Research data used in this research was data of undergraduate thesis title of Industrial engineering study program with the data number of 138.

### B. Text Mining

Text mining involved traditional data mining algorithm such as clustering, classification. Text mining is a repeating process involving analysis repetition by using different setting and using or excluding particular requirements for a better result. The result of this step can be form of document collection, long-term or multi-terms topic list, or rules to solve classification problem. The steps of text mining is shown on Fig. 1 [9]

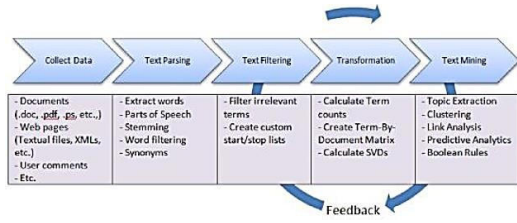


Fig. 1. Text Mining Process Flow

### 1. Collect Data

The first step in text mining research project is collecting textual data that is needed to explore the quality information from the textual data.

### 2. Text Parsing

Textual data parsing is started by taking character sequence (such as sentence sequence in text document) and break it down into tokens (units, where one unit exists in one word, number, or punctuation). This process is called as tokenization. Tokenization process is the process of breaking up sentence or document into word pieces [10]. After the tokens are found in the document, normalization is done to eliminate the word complexity or called as stemming. For computation, stemming functions to reduce all similar word variation.

### 3. Text Filtering

Corpus in thousand documents probably contains a lot of irrelevance, both to differentiate one document and another and to summarize document. Tracking particular terms manually to delete irrelevant terms is a work that often takes time and a subjective task from all text mining steps.

### 4. Calculate Terms Count

Terms counting is carried out by calculating *Term Frequency-Inverse Document Frequency* (tf-idf) [11]. Tf-idf is a numerical statistic that reflects how important a word is to a document in a collection. Tf - IDF is often used as weighting factor in searches of information retrieval and text mining. State that word/term count is explained with equation (1) [12]

$$tfidf(t_i, d_j) = tf(t_i, d_j) \times \log\left(\frac{N}{N(t_i)}\right) \quad (1)$$

where :

- tfidf( $t_i, d_j$ ) = word/ term count towards document  $d_j$
- tf( $t_i, d_j$ ) = number of times word/ term  $t_i$  appears in the document  $d_j$
- N = total number of documents
- N( $t_i$ ) = number of document with word/ term  $t_i$  in it.

### 5. Cosine Similarity

Cosine similarity is a method to measure similarity between two vectors by measuring the cosine of the angle between them. The cosine of 0 is 1, and the bigger angle; the smaller similarity [13]. The cosine similarity is better than jaccard similarity and combination between cosine and jaccard similarity [14]. Cosine similarity is shown in equation (2).

$$\begin{aligned} sim(X_a, X_b) &= \cos \theta = \frac{X_a \cdot X_b}{\|X_a\| \|X_b\|} \\ &= \frac{\sum_{i=1}^d X_a^i \cdot X_b^i}{\sqrt{\sum_{i=1}^d (X_a^i)^2} \times \sqrt{\sum_{i=1}^d (X_b^i)^2}} \end{aligned} \quad (2)$$

Where :

- $X_a$  = number of terms contained in the document a
- $X_b$  = the number of terms contained in the document b
- $i = 1$ , namely the number of terms in each document
- $d$  = each term multiplied by the number of terms in the document.

### 6. K-Means Clustering

K-means clustering is a method that includes in partitioning clustering algorithm group. K-means clustering algorithm is a centroid based methodology in which the similarity of group is measured in concern to the mean estimations of the documents [8]. K-means clustering algorithm is as following:

- a) Determining the number of cluster
- b) Determining the center of each cluster
- c) Calculating centroid or average of the data in each cluster and classify each data to centroid or the average based on the closest range
- d) Back to step c if there is still data that migrate to another cluster or if the centroid score changes.

### 7. Silhouette Coefficient Testing

Silhouette coefficient is used to find out the cluster quality and strength, how good an object is placed in a cluster [13]. Score of silhouette coefficient is shown in equation (3).

$$s(i) = \frac{b(i) - a(i)}{\max\{a(i), b(i)\}} \quad (3)$$

where :

- $s(i)$  = value of silhouette validity with object  $i$
- $a(i)$  = average distance between objects  $i$  with all objects in the same cluster (intracluster)
- $b(i)$  = average distance between objects  $i$  with all objects in the nearest cluster (nearest cluster)
- max = maximum

## III. RESULT AND DISCUSSION

In this research, data obtained from Industrial engineering study program is processed through text mining phases:

### A. Collect Data

Collect data is carried out by collecting data. The data was obtained from coordinator of undergraduate thesis of Industrial Engineering study program. The data obtained is saved in excel format. To process the document, the data is inputted to system and stored in database by using MongoDB. The process of Load Data is shown on Fig. 2.

	0	1	2	3
0	no	nim	nama	judul
1	1	8019001	AGUS DWI KRISTYANTO	Analisis Pengaruh Kualitas Produk dan Kualitas Pelayanan Terhadap Kepuasan Pelanggan Menggunakan Analisis Regresi Linier Berganda (Studi Kasus Pada Cafe Semesta Kota Baru Yogyakarta)
2	2	8019002	ARIEF WICAKSONO	Perancangan Alat Press Produk Placemat Berbahan Enceng Condok dengan Pendekatan Ergonomi guna Mengurangi Kecelakaan Produk dan Meningkatkan Produktivitas
3	3	8019003	TRI NIVI ANDRIANTORO	Perancangan Ulang Alat Penggeser Sandal Dengan Pendekatan Ergonomi Untuk Memperbaiki Posisi Kerja Meningkatkan Output, Dan Mengurangi Tingkat Kecelakaan Produk
4	4	8019005	ALFANHI	Perancangan Ulang Alat Press Sol Sandal Kulit Dengan Pendekatan Ergonomi Untuk Meningkatkan Produktivitas Pada Stasiun Pengapasan (Studi Kasus di UKM Marten's, Jln. Ngr Adsono 1, Dipolek, Yogyakarta)
5	5	8019006	DIAN RYADI	Pengendalian Kualitas dalam Upaya Menekan Tingkat Kecelakaan Produksi Penyamakan Kulit dengan Menggunakan Alat Bantu Statistik
6	6	8019008	YAHYA HASAN	Analisis Faktor-Faktor yang Mempengaruhi Kepuasan Konsumen di Pamela Futsal
7	7	8019009	DITO AULIA DHARMASARIAN CUPRON	Faktor Penghambat dan faktor Pendorong yang Mempengaruhi Niat Beli Pelanggan Belanja Online pada Situs Jual Beli Online dengan Menggunakan Metode Structural Equation Modelling (SEM)

Fig. 2. The Process of Load Data

In this process, data selection per year is also carried out. The document of title per year is shown on Fig. 3.

## Undergraduate Thesis Data

Undergraduate Thesis Data 2012		
Judul	Date	
13. Pengendalian Produk Cacat dengan Metode Taguchi pada Proses Pembuatan Noda di Caca	2012	
14. Pengendalian kualitas Pada Cerbing dengan Menggunakan Metode Desain Faktorial pada Perusahaan Cor Logam "Berkah" Dengan Ngawonggo Cepu (Jalan Jawa Tengah)	2012	
16. Perbaikan Mesin Bor pada Proses Pengapasan Kayu untuk Mengurangi Cacatan dengan Metode Pendekatan Data Antropometri	2012	

## Undergraduate Thesis Data 2013

Judul	Date
2. Perancangan Alat Press Produk Placemat Berbahan Enceng Condok dengan Pendekatan Ergonomi guna Mencegah Kecelakaan Produk dan Meningkatkan Produktivitas	2013
5. Pengendalian kualitas dalam upaya menekan tingkat kecelakaan produksi penyamakan kulit Dengan Menggunakan Alat Bantu Statistik	2013
7. Faktor Penghambat dan Faktor Pendorong yang Mempengaruhi Niat Beli Pelanggan Belanja Online pada Situs Jual Beli Online dengan Menggunakan Metode Structural Equation Modeling (SEM)	2013
8. Perancangan Ulang Wheelbarrow Roda 3 dengan Pendekatan Data Antropometri	2013
12. Perbaikan Fasilitas Kerja pada Proses Pemotongan Mainan Taman Kanak-Kanak yang Ergonomi untuk Meningkatkan Produktivitas	2013
16. Usulan Peningkatan Kualitas Layanan dan Fasilitas Pelancong dengan Metode Quality Function Deployment	2013
17. Sistem Pendukung Keputusan Untuk Pengendalian Persewaan di PT. Delta Utama	2013
19. Perancangan ulang Fasilitas kerja yang Ergonomi pada Proses Pengaliran pada Karangan Alat Peraga Taman Kanak-Kanak	2013
25. Usulan Perbaikan Untuk Peningkatan Sistem Manajemen Mutu ISO 9001 : 2008 Dengan Metode Analytic Hierarchy Process	2013
26. Pengendalian Persewaan dengan Pendekatan Simulasi Monte Carlo Untuk Meminimasi Biaya Persewaan	2013

Fig. 3. The Result of Selection Process

## B. Text Parsing

The process of text parsing is divided into two which are tokenizing and stemming. Tokenizing is used to break down the sentence into words. After tokenizing, stemming and filtering is done. The result of tokenizing, stemming and filtering is shown as the following Fig. 4.

Result Tokenizing									
T0	T1	T2	T3	T4	T5	T6	T7	T8	
0	analisis	pengaruh	kualitas	produk	dan	kualitas	pelayanan	terhadap	kepuasan
1	perancangan	alat	press	produk	placemat	berbahan	enceng	gondok	dengan
2	perancangan	ulang	alat	penggeser	sandal	dengan	pendekatan	ergonomi	untuk
3	perancangan	ulang	alat	press	sol	sandal	kulit	dengan	pendekatan
4	pengendalian	kualitas	dalam	upaya	menekan	tingkat	kecacatan	produksi	penyamakan
5	analisis	faktor-faktor	yang	mempengaruhi	kepuasan	konsumen	di	pamela	futsal
6	faktor	penghambat	dan	faktor	pendorong	yang	mempengaruhi	niat	None
7	perancangan	ulang	wheelbarrow	roda	3	dengan	pendekatan	data	antropometri
8	peningkatan	kualitas	pelayanan	jasa	olah	raga	dengan	menggunakan	metode
9	analisis	swot	sebagai	dasar	perumusan	strategi	perusahaan	berdaya	saling
10	analisa	faktor-faktor	yang	berpengaruh	terhadap	loyalitas	karyawan	None	None
11	perbaikan	fasilitas	kerja	pada	proses	pemotongan	mainan	taman	kanak-kanak
12	pengendalian	produk	cacat	dengan	metode	taguchi	pada	proses	pembuatan
13	pengendalian	kualitas	pada	gerbang	dengan	menggunakan	metode	desain	faktorial
14	analisis	kualitas	pelayanan	manajemen	internal	dengan	metode	statistik	t

Fig. 4. The Result of Tokenizing and Stemming

## C. The process of Document Clustering

Before clustering, document from preprocessing result will be tested with TF IDF. After that, clustering by using K-Means method is carried out. In the clustering process, 3 clusters are used which are Product Ergonomics and Design, Quality Management, and Production system. The result of clustering is shown on the following Fig. 5.

Clustering K-Means		
Result Clustering		
Undergraduate Thesis Data 2012		
Product Ergonomics and Design	Quality Management	Production System
0	perbaikan mesin bor proses pengapasan kayu mengurangi cacatan metode pendekatan data antropometri	pengendalian kualitas gerbang menggunakan metode desain faktorial persewaan cor logam "berkah" dengan menggunakan data antropometri
Undergraduate Thesis Data 2013		
Product Ergonomics and Design	Quality Management	Production System
0	faktor penghambat faktor pendorong mempengaruhi niat beli pelanggan belanja online situs jual beli online menggunakan metode structural equation modeling (sem)	perancangan alat press produk placemat berbahan enceng gondok pendekatan ergonomi mengurangi cacatan produk meningkatkan produktivitas
1	usulan peningkatan kualitas layanan fasilitas pelancong metode quality function deployment	pengendalian kualitas upaya menekan tingkat kecelakaan produksi penyamakan kulit menggunakan alat bantu statistik
2	perencanaan strategi perusahaan metode eum	perbaikan fasilitas kerja proses pemotongan mainan taman kanak-kanak ergonomi meningkatkan produktivitas
3	sistem pendukung keputusan pengendalian persewaan pt. delta utama	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
4	usulan perbaikan pengapasan sistem manajemen mutu iso 9001 : 2008 metode analytic hierarchy process	perancangan ulang fasilitas kerja proses pengaliran karangan alat peraga taman kanak-kanak
5	perancangan charger gadget kapada motor perantara dari power bank menggunakan metode value engineering	perancangan ulang fasilitas kerja proses pengaliran karangan alat peraga taman kanak-kanak
6	pengendalian persewaan pendekatan simulasi monte carlo meminimasi biaya persewaan	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
7	perancangan sistem kerja proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
8	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
9	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
10	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
11	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
12	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
13	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
14	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
15	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
16	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
17	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
18	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
19	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
20	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
21	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
22	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
23	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
24	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
25	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
26	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
27	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
28	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
29	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
30	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
31	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
32	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
33	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
34	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
35	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
36	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
37	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
38	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
39	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
40	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
41	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
42	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
43	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
44	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
45	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
46	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
47	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
48	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
49	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
50	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
51	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
52	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
53	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
54	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
55	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
56	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
57	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
58	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
59	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
60	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
61	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
62	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
63	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
64	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
65	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
66	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
67	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
68	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
69	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
70	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
71	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
72	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
73	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
74	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
75	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
76	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
77	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
78	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
79	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
80	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
81	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
82	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
83	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
84	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
85	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
86	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
87	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
88	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
89	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
90	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
91	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
92	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
93	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
94	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
95	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
96	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
97	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
98	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak
99	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak	perancangan ulang fasilitas kerja ergonomi proses pengaliran karangan alat peraga taman kanak-kanak

Fig. 5. Clustering Result

Clustering result is then presented in the form of undergraduate thesis topic trend graphic. The graphic is shown on the following Fig. 6.

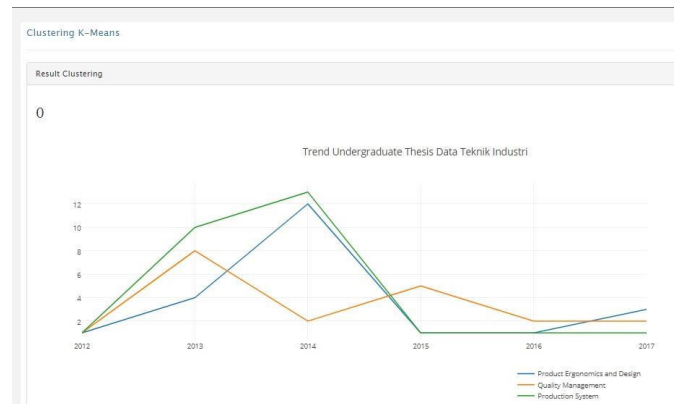


Fig. 6. Undergraduate Thesis Topic Trend Graphic

## D. Testing

From 138 data clustering by using K-Means method, the result of Silhouette Coefficient is 0.5674. With the number of cluster of 3, which are Product Ergonomics and Design, Quality Management, and Production system, the result is relatively low. From the analysis, the wide distribution of thesis title makes the testing score become low. The low score of silhouette coefficient is because the data used is thesis titles written in different words from one to another title.

Clustering result with Silhouette Coefficient 0.5674 can be seen on Fig. 6. And from the graphic on figure 6, it can be seen that undergraduate thesis topic trend of industrial engineering from the three fields is relatively stable but has some difference as following:

1. In 2012-2013 topic on Product Ergonomics and Design and Quality Management increased, but topic on Production System decreased.
2. In 2015-2016 topic on Product Ergonomics and Design and Quality Management decreased, but topic on Production System increased.

## IV. CONCLUSION

Based on the result of the research on the Implementation Text Mining on Undergraduate Thesis Title

Topic Trend Clustering at Industrial Engineering Study Program Universitas Ahmad Dahlan by Using K-Means Clustering with Cosine Similarity”, it can be concluded that:

1. A program with python programming language that can group the thesis titles to show the trend every year has been developed.
2. From the silhouette coefficient testing, the result of silhouette coefficient is 0.5674.

The low score of silhouette coefficient is because the data used is thesis titles written in different words from one to another title. In addition, textual data of thesis title is too widely distributed so it results in low similarity range score from one to another with condition of range cluster = 3. However, if condition of range cluster = 9, 10, 11, the score of silhouette coefficient is relatively high which is 1. Because of the more number of cluster, the textual data of thesis title will position based on the members which have high similarity score.

#### ACKNOWLEDGMENT

This research has been supported by internal research grant of Universitas Ahmad Dahlan with Fundamental research scheme number PF-065/SP3/LPPM-UAD/VI/2018 date 9 June 2018

#### REFERENCES

- [1] V. B. Kobayashi, S. T. Mol, H. Berkers, G. Kismihok, and D. N. Den Hartog, “Text Mining in Organizational Research,” *Organ. Res. Methods*, vol. 21, no. 3, pp. 733–765, 2018.
- [2] A. K. Patidar, J. Agrawal, and N. Mishra, “Analysis of Different Similarity Measure Functions and their Impacts on Shared Nearest Neighbor Clustering Approach,” *Int. J. Comput. Appl.*, vol. 40, no. 16, pp. 1–5, 2012.
- [3] W. Junjie, *Advances in K- Means Clustering : a Data Mining Thinking*. Springer Science & Business Media, 2012.
- [4] W. Xilon and K. Isua, *The Top Ten Algorithms in Data Mining*. London: CRC Press Taylor & Francis Group, 2009.
- [5] S. A. Salloum, A. Q. Alhamad, M. Al-emran, and K. Shaalan, “A Survey of Arabic Text Mining,” *Springer Int. Publ.*, pp. 417–431, 2018.
- [6] A. K. Jain, “Data clustering : 50 years beyond K-means,” *Pattern Recognit. Lett.*, pp. 1–16, 2009.
- [7] L. Zahrotun, “Text Mining for Internship Titles Clustering Using Shared Nearest-Neighbor Method,” *Comput. Eng. Appl.*, vol. 6, no. 3, 2017.
- [8] N. Garg and R. K. Gupta, “Exploration of Various Clustering Algorithms for Text Mining,” *Int. J. Educ. Manag. Eng.*, vol. 4, no. July, pp. 10–18, 2018.
- [9] G. Chakraborty, M. Pagolu, and S. Garla, *PREVIEW: Text Mining and Analysis: Practical Methods, Examples, and Case Studies Using SAS*. 2013.
- [10] C. D. Manning, P. Raghavan, and H. Schutze, *introduction to Information Retrieval*. Cambridge: Cambridge University Press, 2008.
- [11] S. Vijayarani, J. Ilamathi, and M. Nithya, “Preprocessing Techniques for Text Mining - An Overview,” *Int. J. Comput. Sci. Commun. Networks*, vol. 5, no. 1, pp. 7–16, 2015.
- [12] N. L. Processing and T. Mining, *Natural Language Processing and Text Mining*. USA: Springer, 2006.
- [13] C. Plattel, “Distributed and Incremental Clustering using Shared Nearest Neighbours,” Utrecht University, 2014.
- [14] L. Zahrotun, “Comparison Jaccard similarity , Cosine Similarity and Combined Both of the Data Clustering With Shared Nearest Neighbor Method,” vol. 5, no. 1, pp. 11–18, 2016.