

## AI-RTF/ RTF-DCS Fellowship (Completion Report)

1.	Award reference no.	RTF/2018/000033
2.	Research Training Topic	Enhance Filtering Approach based on FP-Growth and Self Constructing Clustering with Hybrid Feedback for Better Accuracy Performance in SME Recommendation System, Computer Science and Enineering
3.	Main scientific objectives	To explore the formula of a recommendation system and a data mining approach to segmenting customers and markets for SMEs Development
4.	Personnel details	
	Name, Address and contact details of the Fellow	Name, Address and contact details of the Indian
	Name : Fitri Marisa Address : Perum IKIP Tegalondo Blok 2J no 20 malang  Contact Detail : +62-81555862223	Name : Dr. Rakesh kumar Pandey Address : KIRORI MAL COLLEGE, University Of Delhi, North Campus,, New Delhi, Delhi 110007  Contact Detail : +91-9811170889
6.	Date of start of the Fellowship	1 July 2019
	Date of completion of the fellowship	1 January 2020

7. **Specific advantages derived:**

**- Expertise**

This joint research provided a lot of positive input specifically my way of scientific thinking. The advice and input from my supervisor influence and change my scientific thinking to be more critical and can see and analyze a problem and with the viewpoint of a scientific solution. The difference in scientific focus between me and the supervisor has provided an alternative field of science that can be explored more broadly for future research, because between physics and computer science there are slices of sets that are very useful for my subsequent studies.

**- Equipment & computational Facilities**

There are no obstacles in the facilities provided by the laboratory of the Kirori Mal College Physics department. All my computer needs and internet access are well available and can support my research for 6 months. The laboratory room is comfortable and conducive for learning and doing research and discussion, also the library room is comfortable enough to support the study of literature.

**- Exchange of Data/Samples**

There are no obstacles in exchanging data and samples because the data and samples I have collected previously from the data of my research object. Then the data is continued to be processed and carried out when I did research during this program. The supervisor has provided input on the data processing that I have done and provided a comparison of existing data in India if needed.

**- Exposure to advanced technologies**

This research is one part of my doctoral research on building a new model of hybrid gamification by assimilating local wisdom which is equipped with a recommendation and data mining system to solve SME network problems. To build a hybrid gamification model, data mining patterns are needed to make recommendations on the knowledge needed by SMEs such as market segmentation, SME level segmentation, and others. For this reason, this research is focused on preparing laboratory-scale formulas and experiments to support this goal. With this hybrid gamification model, SME can be utilized to increase motivation to collaborate and develop their businesses

- **Opportunity for new interactions with any other research Organizations**

This research makes it possible to collaborate with other research institutions especially those research institutes or universities that have concentrations in the field of computer science or social sciences combined with information technology, because in this research also involves knowledge related to social behavior and motivation that focus on how the relationship between gamification and motivation.

- **Participation in Conferences**

One of the outcomes of this research is the receipt of a conference paper, namely THE 1ST INTERNATIONAL CONFERENCE ON INNOVATION AND APPLICATION OF SCIENCE AND TECHNOLOGY (ICIASTECH), in Malang City, East Java Province, Indonesia. The conference was held on 2 -3 October 2019. I was unable to attend the presentation of the paper due to constraints from the organizers of the fellowship (AIRTF) who were not allowed to leave India during the fellowship. However, upon submission to the conference committee, this paper is still accepted and will be published in the IOP Conference series indexed by Scopus in the February 2020 issue.

**8. Salient outcomes/accomplishments:**

List of joint research publications (Please attach copies)	Attachment-2
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**9. Conclusion (summarize the achievements and indication of scope for future work)-**

The achievement that has been obtained in this research is a system of recommendations and extracting SME data that can be used for decision making and for further research development.

In detail there are 2 formulas produced:

1. The field of data mining

The clustering approach has been able to explore SME data to analyze possibilities that can be used as judgment to make decisions in the development and evaluation of the company. From the results of the iterations can be found; first, based on the customers' number, the groups can be classified into three C1(18%) is auto-transfer payment, C2 (45%) is post-date payment, C3 (36%) is non-auto-transfer and combination payment.

Three (3) clusters formed resulted in the finding that the most transaction contributors were customers with a post-date payment system. Based on the average number of transactions, post-date payments was in the first rank (12.7 / week). This finding can provide advice for SMEs that many transactions by customers should also be balanced with the availability of capital. The smallest number of transactions is the customer with an auto-transfer system means that customers have a tendency to be less interested in the payment system at the beginning, in other hand, they rely more on capital from SMEs. This can be a concern for SME managers to react to it. Determination of the number of clusters in this study is still done manually. In future work, it is necessary to think about the validity of the right number of clusters so that the results of grouping will be more accurate.

## 2. The fiend of recommendation system

Challenge in developing a collaborative filtering (CF)-based recommendation system is the problem of cold-starting of items that causes the data to sparse and reduces the accuracy of the recommendations. Therefore, to produce high accuracy a match is needed between the types of data and the approach used. Two approaches in CF include user-based and item-based CFs, both of which can process two types of data; implicit and explicit data. This work aims to find a combination of approaches and data types that produce high accuracy. Cosine-similarity is used to measure the similarity between users and also between items. Mean Absolute Error is also measured to discover the accuracy of a recommendation. Testing of three groups of data based on sparseness results in the best accuracy in an explicit data-based approach that has the smallest MAE value. The result is that the average MAE value for user based (implicit data) is 0.1032, user based (explicit data) is 0.2320, item based (implicit data) is 0.3495, and item based (explicit data) is 0.0926. The best accuracy is in the item-based (explicit-data) approach which is the smallest average MAE value.

For future research, the results of this study can be a reference in exploring SME data and for the broader interest can be combined with a gamification approach where this formula can be a support as a recommendation system.

(Signatures of Fellow)

Name : Fitri Marisa

Address: Universitas Widyagama Malang  
Jl. Borobudur no 35 Malang - Indonesia

(Signatures of the Indian host)

Name : Dr. Rakesh Kumar Pandey

Address: Kirori Mal College (KMC)  
Delhi University – New Delhi

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**Attachment-1 : Accomplishment Status : (vis-à-vis the fellowship objectives and milestones, highlighting the major/salient achievements)**

**Research Topic :**

Enhance Filtering Approach based on FP-Growth and Self Constructing Clustering with Hybrid Feedback for Better Accuracy Performance in SME Recommendation System, Computer Science and Engineering

**Objective:**

To explore the formula of a recommendation system and a data mining approach to segmenting customers and markets for SMEs Development

**Milestone :**

Month	Activities and achievement
June	Literature study of SME, collecting data from Indonesia and India SMEs
July	<ul style="list-style-type: none"> <li>- Literature study of Recommendation system (Collaborative filtering), Data mining K-Means Clustering approach, explicit and implicit data characteristics</li> <li>- Doing experiment of clustering for customer data of SME</li> <li>- Writing paper for mining of SME data to cluster segmentation on customer in SME</li> <li>- Preparing conference publication</li> <li>- The paper theme : The Analyze of Relationship between Revenue and Customer Payment Methods in Small Medium Enterprise Based on Clustering K-Means</li> </ul>
August	<ul style="list-style-type: none"> <li>- Literature study of Recommendation system (Collaborative filtering), Data mining K-Means Clustering approach, explicit and implicit data characteristics</li> <li>- Doing experiment of Collaborative filtering of Recommendation System with explicit and implicit data of SME transaction.</li> </ul>

	<ul style="list-style-type: none"> <li>- Writing paper for recommendation system (collaborative filtering)</li> <li>- Submit conference paper: The Analyze of Relationship between Revenue and Customer Payment Methods in Small Medium Enterprise Based on Clustering K-Means</li> <li>- Name of conference: THE 1ST INTERNATIONAL CONFERENCE ON INNOVATION AND APPLICATION OF SCIENCE AND TECHNOLOGY (ICIASTECH),</li> <li>- Place of conference : Malang City, East Java Province, Indonesia</li> <li>- Date of Conference : 2-3 October 2019</li> <li>- Status of submission: Accepted</li> <li>- Name of publication: IOP Conference series on Februari 2020 (scopus and Web of Science Indexed)</li> </ul>
September	<ul style="list-style-type: none"> <li>- Literature study of Recommendation system (Collaborative filtering), Data mining K-Means Clustering approach, explicit and implicit data characteristics</li> <li>- Literature study of gamification models for SME networking</li> <li>- Submit scopus journal paper: Performance Comparison of Collaborative-Filtering Approach with Implicit and Explicit Data</li> <li>- Name of journal : (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 10, No. 10, 2019 (scopus and Web of Science Indexed)</li> <li>- Status : Accepted</li> </ul>
Nopember	<ul style="list-style-type: none"> <li>- Literature study of gamification models for SME networking</li> <li>- Doing revision of accepted paper</li> <li>- The paper has published on 1 November 2019</li> <li>- Name of journal : (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 10, No. 10, 2019 (scopus and Web of Science Indexed)</li> </ul>

December	<ul style="list-style-type: none"><li>- Writing fellowship completing report</li><li>- Collecting research contingency</li><li>- Finishing completing report</li></ul>



# Attachment-2 : List of joint research publications

## 1. Accepted Conference

### Proof Archieve



### #36 (1570584786): The Analyze of Relationship Between Revenue and Customer Payment Methods in Small Medium Enterprise Based on Clustering K-Means



Property	Change Add	Value																																																	
Conference and track		The 1st International Conference on Innovation and Application of Science and Technology 2019 - Electrical, Electronic, and Informatics Engineering																																																	
Authors		<table border="1"> <thead> <tr> <th>Name</th> <th>ID</th> <th>Edit</th> <th>Flag</th> <th>Affiliation (edit for paper)</th> <th>Email</th> <th>Country</th> </tr> </thead> <tbody> <tr> <td>Fitri Marisa</td> <td>1359002</td> <td></td> <td></td> <td>Widyagama University of Malang, Indonesia</td> <td>fitrimarisa@widyagama.ac.id</td> <td>Indonesia</td> </tr> <tr> <td>Sharifah Sakinah Syed Ahmad</td> <td>1138753</td> <td></td> <td></td> <td>Universiti Teknikal Malaysia Melaka, Malaysia</td> <td>sakinah@utem.edu.my</td> <td>Malaysia</td> </tr> <tr> <td>Zeratul Izzah Mohd Yusoh</td> <td>1376447</td> <td></td> <td></td> <td>Universiti Teknikal Malaysia Melaka, Malaysia</td> <td>zeratul@utem.edu.my</td> <td>Malaysia</td> </tr> <tr> <td>Tubagus Mohammad Akhriza</td> <td>1671262</td> <td></td> <td></td> <td>Pradnya Paramita School of Informatics Management and Computer, Indonesia</td> <td>akhriza@stimata.ac.id</td> <td>Indonesia</td> </tr> <tr> <td>Wiwini Purnomowati</td> <td>1688040</td> <td></td> <td></td> <td>Widyagama University of Malang, Indonesia</td> <td>anisa_iwin@yahoo.com</td> <td>Indonesia</td> </tr> <tr> <td>Rakesh Pandey</td> <td>1718305</td> <td></td> <td></td> <td>University of Delhi, India</td> <td>rkpandey@kmc.du.ac.in</td> <td>India</td> </tr> </tbody> </table>	Name	ID	Edit	Flag	Affiliation (edit for paper)	Email	Country	Fitri Marisa	1359002			Widyagama University of Malang, Indonesia	fitrimarisa@widyagama.ac.id	Indonesia	Sharifah Sakinah Syed Ahmad	1138753			Universiti Teknikal Malaysia Melaka, Malaysia	sakinah@utem.edu.my	Malaysia	Zeratul Izzah Mohd Yusoh	1376447			Universiti Teknikal Malaysia Melaka, Malaysia	zeratul@utem.edu.my	Malaysia	Tubagus Mohammad Akhriza	1671262			Pradnya Paramita School of Informatics Management and Computer, Indonesia	akhriza@stimata.ac.id	Indonesia	Wiwini Purnomowati	1688040			Widyagama University of Malang, Indonesia	anisa_iwin@yahoo.com	Indonesia	Rakesh Pandey	1718305			University of Delhi, India	rkpandey@kmc.du.ac.in	India
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submitted paper	Only the chairs can edit	The Analyze of Relationship Between Revenue and Customer Payment Methods in Small Medium Enterprise Based on Clustering K-Means																																																	
Abstract	Only the chairs can edit	Business capital and revenue are not only the decisive of the health of SMEs but also they must be balanced. In general, customers find their benefit from the flexible payment methods while on the other hand the SMEs should get their benefit too. So that, it needs to be studied whether it is necessary for SMEs to get their profit in accordance to this situation. One of the methods that suitable to be applied is by applying customer groupings based on revenue and payment namely the K-means clustering method since it can raise several groups that have not been known before. This information is useful for SMEs to be utilized based on their needs. Data in this study were gathered from customer attributes, number of transactions, and payment methods. The number of centroids was 3. The grouping results were stopped at the 5th iteration. The finding showed that the ratio value of the 4th iteration and the 5th iteration having the same ratio value, 0.07393. From the results of the iterations can be found: first, based on the customers' number, the groups can be classified into three C1(8%), C2 (5%), C3 (6%). Second, based on the average number of transactions, post-paid payments was in the first rank (12.7 / week). From the results, it can be analyzed that this situation is burdensome for SMEs because the more the number of transactions, the more investment must be prepared for accounts receivable.																																																	
Keywords	Only the chairs can edit	Clustering; Transaction; Payment-method; Small Medium Enterprise																																																	
Topics	Only the chairs can edit	Electrical, Electronic and Informatics Engineering																																																	

Presenter(s)		presenter not specified								
DOI	Only the chairs can edit									
Status		Accepted								
Review manuscript		<p>However, authors cannot upload: paper status</p> <table border="1"> <thead> <tr> <th>Document (show)</th> <th>Pages</th> <th>File size</th> <th>Changed</th> </tr> </thead> <tbody> <tr> <td></td> <td>162,759</td> <td>Aug 9, 2019 10:30:25 Asia/Jakarta</td> <td></td> </tr> </tbody> </table> <p>The case of the paper title 'The Analyze of Relationship Between Revenue and Customer Payment Methods in Small Medium Enterprise Based on Clustering K-Means' does not agree with the registered entry: <a href="#">Open Access proceedings Journal of Physics: Conference seriesThe Analyze of Relationship between Revenue and Customer Payment M</a></p> <p>docx papertitle_case</p> <p>docx authname Doubleblind conference, but author name 'Syed Ahmad' is visible on first page. (This is only a warning; ignore if false positive.) See <a href="#">FAQ</a> for details.</p>	Document (show)	Pages	File size	Changed		162,759	Aug 9, 2019 10:30:25 Asia/Jakarta	
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Final manuscript	Could upload until Sep 11, 2019 23:59:59 WIB.	<p>However, authors cannot upload: final deadline</p> <table border="1"> <thead> <tr> <th>Document (show)</th> <th>Pages</th> <th>File size</th> <th>Changed</th> </tr> </thead> <tbody> <tr> <td></td> <td>153,426</td> <td>Aug 22, 2019 14:13:13 Asia/Jakarta</td> <td></td> </tr> </tbody> </table> <p>The case of the paper title 'The Analyze of Relationship Between Revenue and Customer Payment Methods in Small Medium Enterprise Based on Clustering K-Means' does not agree with the registered entry: <a href="#">Open Access proceedings Journal of Physics: Conference seriesThe Analyze of Relationship between Revenue and Customer Payment M</a></p> <p>docx papertitle_case</p>	Document (show)	Pages	File size	Changed		153,426	Aug 22, 2019 14:13:13 Asia/Jakarta	
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## Personal notes



You are the creator, an author and a reviewer for this paper. You have authored an accepted paper.

## Reviews

### 2 Reviews

#### Review 1 (Reviewer A)

Relevance and Timeliness	Technical Content and Scientific Rigour	Novelty and Originality	Quality of Presentation	Recommendation
Acceptable. (3)	Valid work but limited contribution. (3)	Significant original work and novel results. (4)	Readable, but revision is needed in some parts. (3)	Likely Accept (This paper should be accepted but I will not champion it) (4)

#### Recommended Changes (Recommended changes. Please indicate any changes that should be made to the paper if accepted.)

Abstract  
how much data is used in research  
what is meant by C1 (8%), C2 (5%) and C3 (6%)?  
Why did the results of the research not display the results from table 7?

suggestion  
Thus, from the results of segmentation, most payment methods are Post-Date. Therefore, SMEs require a lot of capital or business relationships for money debt.

- Introduction  
References are used no more than 10 years
- CLUSTERING METHOD IN DATA MINING  
Figure 1 has not been mentioned and explained in paragraphs  
Figure 1 replace with maximum resolution quality  
typo Article |research methodology
- Experiment and Result  
why is the Payment system category divided into four in table 2?  
Whereas in table 1 there are three categories  
Why is the cluster divided into 3? why not divide into 4  
Graph 1 is replaced by Figure 3
- Conclusion  
please write the quantitative results of the research

#### Review 2 (Reviewer C)

Relevance and Timeliness	Technical Content and Scientific Rigour	Novelty and Originality	Quality of Presentation	Recommendation
Good. (4)	Marginal work and simple contribution. Some flaws. (2)	Minor variations on a well investigated subject. (2)	Readable, but revision is needed in some parts. (3)	Likely Accept (This paper should be accepted but I will not champion it) (4)

#### Recommended Changes (Recommended changes. Please indicate any changes that should be made to the paper if accepted.)

Knowledge discovery in Database (KDD) is defined as potential, implicit and unknown information extraction from a set of data. [13], [14]. Sentences are not given a dot before citation.

This is applicable research. Good idea. The sample is clear, by giving the name of the consumer clearly without initial. However, it is not clear what product to buy. Dividing consumers into groups based on how to pay for the product purchased, but not yet explained what products are purchased. The solution, maybe by explaining the types of SMEs that are the object of research.

Acknowledgment, it should be aimed more at funders, funding sources, not for the reviewers.

## Manuscript: Attachment-2A

## 2. Published Scopus Journal

<https://thesai.org/Publications/ViewPaper?Volume=10&Issue=10&Code=IJACSA&SerialNo=16>

## Proof of accepted:



Editor IJACSA <editorijacsa@thesai.org>

Tue, Oct 15, 10:23 AM



to me, sakinah, zeratul, Riza, anisa\_iwin, r.kr.pandey ▾

Dear Author(s),

Congratulations, your submitted paper titled "Performance Comparison of Collaborative-Filtering Approach with Implicit and Explicit Data" has been reviewed and accepted for publication in the International Journal of Advanced Computer Science and Applications (IJACSA) - Volume 10 No 10 October 2019.

### Registration and Publication Fee Payment

You may now proceed with the online registration for paper publication at [www.thesai.org/Home/FeePayment](http://www.thesai.org/Home/FeePayment). If you do not have any credit/debit card available or the payment process fails, please get in touch with us.

Kindly register before **21st October 2019** for timely publication and indexing of your paper.

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Upon publication of papers, our next steps will be to submit all published papers in International Indexes and University Libraries. Some of the indexes include **Web of Science, Scopus, Inspec, Ebesco, Microsoft Academic, WorldCat**.

IJACSA is also indexed in the Thomson Reuters Emerging Sources Citation Index and is also listed in the Thomson Reuters Master Journal List - <http://science.thomsonreuters.com/cgi-bin/jrnlist/jresults.cgi?PC=MASTER&ISSN=2158-107X>

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### Reviewer Feedback

All submitted manuscripts were subject to a double-blind peer review process. The Editorial Board has decided that the reviewers' feedback will be emailed to the author(s) after successful registration.

Wishing you all the best and hope to hear from you soon,

Regards,

Editor

IJACSA

The Science and Information (SAI) Organization

## Revision Achieved:



Editor IJACSA <editorijacsa@thesai.org>

Sat, Oct 19, 5:55 PM



to me, sakinah, zeratul, Riza, anisa\_iwin, r.kr.pandey ▾

Dear Author,

Please find the attached Reviewer Feedback of your manuscript "Performance Comparison of Collaborative-Filtering Approach with Implicit and Explicit Data".

Kindly revise your paper as per the feedback attached herewith and send us an updated version following the SAI Paper format (attached). Please submit your camera ready paper (both .docx and .pdf format) on or before October 25, 2019 for publication in IJACSA October 2019.

Tentative Publication Date - 1 November 2019

If you have prepared your paper in Latex, there is no need to submit a .docx file (Submit Latex sources with .pdf file). You may download the Latex Paper Format from

<http://thesai.org/Home/Downloads>

Our publication team is experienced in handling most of the formatting issues in the manuscripts. While there are instances when a issue cannot be resolved, only in those cases the manuscript may be shifted to the next issue. There will be no other extra charges nor there will be any liabilities. We are fully committed to the satisfaction of the authors and are always there to assist you in best possible manner.

Thank you for considering IJACSA as a medium for publication of your work.

Regards,

Editor

IJACSA



**Editor IJACSA** <editorijacsa@thesai.org>  
to me ▾

📧 Tue, Oct 22, 6:00 PM ★ ↶ ⋮

Dear Author(s),

Your camera ready paper titled "Performance Comparison of Collaborative-Filtering Approach with Implicit and Explicit Data" was sent to the publication team for final review and processing and there are some shortfalls noticed in your camera ready submission:

- Multiple figures are numbered as Figure 2 and 3, subsequently; figures should be cited in the text.
- References [4], [7], [8], [10] and [11] are not cited in text.

Kindly make the suggested corrections **in the attached file only** and submit a revised version of your paper on or before 23 October 2019 to be considered in IJACSA.

Looking forward to your response.

### Proof of Published Article:

https://thesai.org/Publications/ViewPaper?Volume=10&Issue=10&Code=IJACSA&SerialNo=16

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### Performance Comparison of Collaborative-Filtering Approach with Implicit and Explicit Data

Author 1: Fitri Marisa Author 2: Sharifah Sakinah Syed Ahmad Author 3: Zeratul Izzah Mohd Yusoh  
Author 4: Tubagus Mohammad Akhriza Author 5: Wiwin Purnomowati Author 6: Rakesh Kumar Pandey

Digital Object Identifier (DOI) : [10.14569/IJACSA.2019.0101016](#) FULL TEXT

Article Published in International Journal of Advanced Computer Science and Applications(IJACSA), Volume 10 Issue 10, 2019.

[Abstract and Keywords](#) [How to Cite this Article](#) [BibTeX Source](#)

Manuscript : Attachmen-2b