



**UNIVERSITI PUTRA MALAYSIA**

***REPUTATION-BASED TASK ALLOCATION FOR IMPROVING  
REALIBILITY IN  
CROWDSOURCING***

**MOHD KHAIRUL SAZANEY ABU JAZIZ (GS 42986)**

**FSKTM 2017 11**



**REPUTATION-BASED TASK ALLOCATION FOR IMPROVING REALIBILITY IN  
CROWDSOURCING**

By

**MOHD KHAIRUL SAZANEY ABU JAZIZ (GS 42986)**

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,  
in Fulfilment of the Requirements for the Master of Computer Science

**JANUARY 2017**

All material contained within the thesis, including without limitation text, logos, icons, photographs and all other artworks, is copyright material of Universiti Putra Malaysia unless otherwise stated. Use may be made of any material contained within the thesis for non-commercial purposes from the copyright holder. Commercial use of material may only be made with the express, prior, written permission of Universiti Putra Malaysia.

Copyright © Universiti Putra Malaysia



## ABSTRACT

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the Master of Computer Science

### REPUTATION-BASED TASK ALLOCATION FOR IMPROVING REALIBILITY IN CROWDSOURCING

By

**MOHD KHAIRUL SAZANEY BIN ABU JAZIZ**

**JANUARY 2017**

**Supervisor : Dr Masnida Haji Hussin**

**Faculty : Faculty of Computer Science and Information Technology**

**Abstract:** Crowdsourcing has been increasing popular nowadays. The act of outsourcing job or task to the group of unknown individuals without any commitment like usual benefit given to the employee has gained acceptance to the not only corporate world but also to a world leader. Website that can be access anywhere and anytime is one of the attraction or key factor for them to use this new wave of employment. The crowdsourcing system such as Amazon Mechanical Turk (MTurk) which has millions of registered user base offer requester to post a task that can be solved by a group or an individual of workers with a minimum fee. In return, the reward will be given to the successful worker determine by the requester or evaluator. In a borderless world, chances of

malicious or adversaries attempt is high. Moreover, the requester does not have any profile of workers who work for them. Any slight of bad result will jeopardize the outcome of their company's operation and the reliability of crowdsourcing system. In realizing that, we are proposing to introduce a reputation management to be embedded into crowdsourcing before appointing tasks to the worker. The workers will be scrutinized their trustworthiness before assign the task to them. Hence, our objective is to design the trustiness scheme for crowd worker and develop a reputation-based resource allocation using trust factor The experiment has been conducted and the result shows that the reliable worker always guarantee that all task can be executed within task duration time given.

## ABSTRAK

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah sarjana Sains Komputer

### REPUTATION-BASED TASK ALLOCATION FOR IMPROVING REALIBILITY IN CROWDSOURCING

Oleh

**MOHD KHAIRUL SAZANEY BIN ABU JAZIZ**

**JANUARI 2017**

**Penyelia : Dr Masnida Haji Hussin**  
**Fakulti : Fakulti Sains Komputer dan Teknologi Maklumat**

**Abstrak:** *Crowdsourcing* telah meningkat popular pada masa kini. Perbuatan kerja penyumberan luar atau tugas kepada sekumpulan individu yang tidak dikenali sebelum sebarang komitmen seperti faedah biasa diberikan kepada pekerja tersebut telah mendapat penerimaan bukan sahaja dunia korporat tetapi juga kepada pemimpin dunia. Laman web yang boleh diakses di mana sahaja dan bila-bila masa adalah salah satu daripada tarikan atau faktor utama bagi mereka untuk menggunakan gelombang pekerjaan baru ini. Sistem *crowdsourcing* seperti Amazon Mekanikal Turk (MTurk) yang mempunyai berjuta-juta pengguna berdaftar menawarkan perkhidmatan kepada majikan untuk mengiklankan tugas yang boleh diselesaikan oleh kumpulan atau pekerja individu dengan bayaran minimum. Sebagai balasan, ganjaran akan diberikan kepada pekerja yang

berjaya. Dalam dunia tanpa sempadan, percubaan yang berniat jahat dari musuh adalah tinggi. Selain itu, majikan juga tidak mempunyai profil pekerja yang bekerja untuk mereka. Hasil pekerjaan yang tidak menepati citarasa majikan akan menjejaskan operasi syarikat mereka dan kebolehpercayaan sistem *crowdsourcing*. Dalam merealisasikan itu, kami bercadang untuk memperkenalkan pengurusan reputasi untuk digabungkan ke dalam *crowdsourcing* sebelum pemberian tugas-tugas kepada pekerja. Para pekerja akan dipaparkan berdasarkan pengalaman mereka dengan sistem dan pendapat lain dari rakan-rakan mereka. Jika nilai kepercayaan mereka adalah tinggi, peminta atau majikan berasa yakin boleh menyerahkan tugas itu kepada mereka. Oleh itu, objektif kami adalah untuk mengkaji faktor kebolehpercayaan pekerja untuk dicadangkan dalam pengurusan sumber berdasarkan reputasi kepada pekerja dari kalangan orang ramai. Eksperimen telah dijalankan dan hasilnya menunjukkan bahawa pekerja yang dipercayai selalu dapat menyiapkan semua tugas dalam tempoh masa yang ditetapkan.

## DEDICATIONS

*This thesis is dedicated to:*

*All my family*

*Thank you for the support, encouragement and constant love.*

*Also to my supervisor, Dr Masnida Haji Hussin*

*Your encouragement, support, advice and guidance are outline to my achievement.*

*Finally, thank you to all my friends.*

*Thank you for the support and encouragement.*



## ACKNOWLEDGEMENT

First and foremost, praise is for *Allah Subhanahu Wa Ta'ala* for giving me the strength, guidance and patience to complete this thesis.

I would like to express the deepest appreciation to my supervisor, Dr Masnida Haji Hussin, for her patient, truthful guidance and unlimited confidence towards me. I would also thank her for being open to ideas, keep encouraging and helping me to shape my interest and ideas.

My sincere thanks and gratitude also dedicated to Dean, Head of Network and Communication Technology Department and members of FSKTM for their endless support. Their care and support help me overcome setbacks and stay focused on my graduate study. I am deeply appreciate their trust in me.

I would like to thank to Dr Abdullah Muhammed for his encouragement and insightful comments.

My greatest appreciation goes to my friends especially in Universiti Putra Malaysia, who were always a great support on facing all struggles and frustrations in my studies. Thanks to them for questioning me about my ideas with help me think rationally and sometimes hearing my problems.

I am very grateful to my lovely parents, my wife and all my big family for them believe in me, their continuous love and supports in my decisions.

Finally, I would like to thank to everybody who takes part in making this thesis successful.

## APPROVAL

This thesis submitted to the Faculty of Computer Science and Information Technology of Universiti Putra Malaysia and has been accepted as fulfilment of the requirements for the degree of Master of Computer Science (Distributed Computing).

Accepted and approved by,

---

Dr Masnida Haji Hussin  
Senior Lecturer

Department of Network and Communication  
Technology Department

Faculty of Computer Science and  
Information Technology

Universiti Putra Malaysia

Date: \_\_\_\_\_

## DECLARATION

I declare that the report is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or any other institution.

---

MOHD KHAIRUL SAZANEY BIN ABU JAZIZ

Date:

## TABLE OF CONTENTS

<b>ABSTRACT</b> .....	i
<b>ABSTRAK</b> .....	iii
<b>DEDICATIONS</b> .....	v
<b>ACKNOWLEDGEMENT</b> .....	vi
<b>APPROVAL</b> .....	vii
<b>DECLARATION</b> .....	viii
<b>LIST OF FIGURES</b> .....	xi
<b>LIST OF TABLES</b> .....	xii
<b>LIST OF ABBREVIATIONS</b> .....	xiii
<b>CHAPTER 1</b> .....	1
<b>INTRODUCTION</b> .....	1
<b>1.1 Background</b> .....	1
<b>1.2 Problem Statement</b> .....	2
<b>1.3 Objective and Scope</b> .....	3
<b>1.4 Thesis Outline</b> .....	4
<b>CHAPTER 2</b> .....	5
<b>LITERATURE REVIEW</b> .....	5
<b>2.1 Introduction</b> .....	5
<b>2.2 Trust and reputation management</b> .....	5
<b>CHAPTER 3</b> .....	11
<b>METHODOLOGY</b> .....	11
<b>3.1 Introduction</b> .....	11
<b>3.2 System Model</b> .....	11
<b>3.3 Trustiness Scheme</b> .....	12
.....	14
<b>3.3.1 Reliability worker</b> .....	15
<b>3.3.2 Reputation score</b> .....	16
<b>3.3.3 Requester satisfaction</b> .....	16
<b>3.4 Resource allocation</b> .....	17
<b>3.4.1 Execution Time</b> .....	18

3.4.2	Average Utilization.....	18
3.5	Simulation definition .....	19
3.6	Simulation experiment.....	19
CHAPTER 4	.....	21
RESULTS AND DISCUSSION	.....	21
4.1	Reliable worker .....	21
4.2	Reputation Score .....	23
4.3	Requester satisfaction.....	25
4.4	Execution time .....	26
4.5	Utilization .....	27
CHAPTER 5	.....	29
CONCLUSION AND FUTURE WORKS	.....	29
5.1	Conclusion.....	29
5.2	Future work.....	29
CHAPTER 5	.....	30
BIBLIOGRAPHY AND REFERENCES	.....	30



## LIST OF FIGURES

Figure 1: An illustrative crowdsourcing platform with endorsement links.....	7
Figure 2: Competitive Environment.....	8
Figure 3: Overview of SACRM Scheme .....	9
Figure 4: Crowdsourcing System Model .....	12
Figure 5: Flowchart of reputation-based task allocation .....	14
Figure 6: RBT simulation output .....	20
Figure 7: Reliable Worker result .....	21
Figure 8: Reputation score simulation result compare to benchmark .....	23
Figure 9: Requester satisfaction RBT compare with benchmark .....	25

LIST OF TABLES



© COPYRIGHT UPM

## LIST OF ABBREVIATIONS

MTurk	Amazon MTurk
RBT	Reputation-based Task
EndorTrust	Endorsement Trust





# CHAPTER 1

## INTRODUCTION

### 1.1 Background

Since the introduction of computer in this world, many problems or challenges faces by the human being will be tried, simplified and solved by the computer. It is ubiquitous that we can found in our work, house or even in our own pocket. It help us to execute many task either complex or simple either individually or group it with others computers.

Lately the arriving of cloud computing had make a great impact to the business and industry revolution. The cloud computing technologies had provide many benefit to the mankind particularly to the organization by not focusing too much on setup and maintaining the business infrastructure but focusing more to their core business instead. Already now we can see businesses are playing catch up each other by embracing this new technology in their own organization. One of the sector who took full advantage of it is e-commerce which are projected to give more income to the entrepreneurs in years ahead.

Although the computers together with new technologies like cloud computing can help and solve many complex problem but human is still needed at some way. The ability to handle tasks like transcription of document, review articles or evaluate the quality of ranking are huge computing task by the advanced computer algorithm which can take days, months or years to complete while it can take a less time if done by the human collaboration.

Usually companies are using their own employees to execute all task either technical or operational with the bounded time period but not all tasks can be executed in due time. That's why some companies are outsourcing some of their task to other company or outside people. This is called outsourcing. Each of the task are handle by group of expert people and their outputs are evaluated by the expert before that companies pay them accordingly for their effort.

While it seems ideal, the engaging of experts to evaluate is a lengthy process which can give a management a headache and hard to swallow. One of the opportunity is engaging the crowd to do the job for them. This is a birth of an era that we call crowdsourcing revolution. Crowdsourcing has emerged recently due to the constraint of the businesses to deliver their product/services at faster rate to the consumer. Note that all this done using the Internet that can be found anywhere.

## **1.2 Problem Statement**

Basically crowdsourcing involve three components namely requester, workers and crowdsourcing system. The requester may issue task on the crowdsourcing systems website with clear deadline and some reward. Once workers read and understand the task given and committed to do the job, they will bid to get a job and execute it diligently. The quality of worker's finish task or job is critical to the requester. The requester might use the result to predict, penetrate other market or helping others. Example of crowdsourcing system is been implemented by Amazon in their offering services namely Amazon Mechanical Turk (MTurk).

Moreover in crowdsourcing, there is no employee-employer relationship between requester and worker like the traditional organization or company. The worker is anonymous. The requester has no idea who they deal with but they expect to get the result in time given.

Another challenge is one could argue that the quality of unknown worker is not on par with our own employee. They could be a genuine worker that want to help us or a malicious worker who want to maximize their own profit. It could be worse if the worker's finish result is not according to the requester expectation, the requester might issue another cycle to get a good or quality job which could incur additional cost. The nightmare may not over if the low quality job still appear in the second cycle but the crowdsourcing system need to reimburse reward to worker. This could give a new dilemma to the requester.

### **1.3 Objective and Scope**

Thus the following research question pop out in our mind:

1. What is the factor that used to evaluate the trustiness of crowd-worker in crowdsourcing?
2. How reputation can improve the reliability of crowdsourcing?

Hence, it motivate us to explore more on the above issue in order to shed some light in this crowdsourcing domain. Our objective of this project as follows:

1. To design the trustiness scheme of crowd-worker in crowdsourcing.  
This scheme could help crowdsourcing system to evaluate the quality of workers in their environment.

2. To develop reputation-based resource allocation using trust factor.

The trust factor that exist between worker and requester can be used to build a reputation system. That reputation database could help requester or crowdsourcing system to allocate task to a good worker in order to get a good or reliable quality task output.

This thesis propose the crowdsourcing system to consider using trustiness scheme with a reputation in their decision making process before allocating task to the specified worker. By evaluating the past performance of worker and their rating, the crowdsourcing system could provide good and reliable services to the requester thus achieving a good image for the crowdsourcing itself. We also convinced that introducing the reputation will not violate the time frame/duration given to for each task to be completed. The propose solution has been evaluated in our experiment simulation. It significantly helps the requester and crowdsourcing system in making a good decision on assigning task to the worker.

#### **1.4 Thesis Outline**

This thesis is organized in six chapters including this chapter. The following paragraphs provide brief descriptions of the remaining chapters of this thesis: Chapter 2 provides the overview of all related to reputation in crowdsourcing and other previous work done in this area. Chapters 3 describe brief information of the methodology conducted. Chapter 4 presents the result and analysis related to the experiment. Chapter 6 presents the conclusions together with thesis contribution and identifies some areas for future work.

## CHAPTER 5

### BIBLIOGRAPHY AND REFERENCES

- [1] A. Josang, R. Ismail, and C. Boyd, "A survey of trust and reputation systems for online service provision," *Decis. Support Syst.*, vol. 43, no. 2, pp. 618–644, 2007.
- [2] H. Yu, Z. Shen, C. Miao, and B. An, "Challenges and opportunities for trust management in crowdsourcing," in *Proceedings - 2012 IEEE/WIC/ACM International Conference on Intelligent Agent Technology, IAT 2012*, 2012, vol. 2, pp. 486–493.
- [3] B. E. Commerce, B. E. Commerce, A. Jøsang, and R. Ismail, "The Beta Reputation System," in *IN PROCEEDINGS OF THE 15TH BLED ELECTRONIC COMMERCE CONFERENCE*, 2002.
- [4] O. Folorunso and O. A. Mustapha, "A fuzzy expert system to Trust-Based Access Control in crowdsourcing environments," *Appl. Comput. Informatics*, vol. 11, no. 2, pp. 116–129, 2015.
- [5] H. Yu, Z. Shen, and C. Leung, "Bringing reputation-awareness into crowdsourcing," in *ICICS 2013 - Conference Guide of the 9th International Conference on Information, Communications and Signal Processing*, 2013, pp. 1–5.
- [6] C. Wu, T. Luo, F. Wu, and G. Chen, "EndorTrust: An Endorsement-Based Reputation System for Trustworthy and Heterogeneous Crowdsourcing," *2015 IEEE Glob. Commun. Conf.*, no. August 2016, pp. 1–6, 2015.
- [7] A. Peleteiro, J. C. Burguillo, M. Luck, J. LI, and J. A. Rodríguez-aguilar, "Using reputation and adaptive coalitions to support collaboration in competitive environments," *Eng. Appl. Artif. Intell.*, vol. 45, pp. 325–338, 2015.
- [8] J. Ren, Y. Zhang, K. Zhang, and X. (Sherman) Shen, "SACRM: Social Aware Crowdsourcing with Reputation Management in mobile sensing," *Comput.*

*Commun.*, vol. 65, pp. 55–65, 2015.

- [9] H. Xie, J. C. S. Lui, and D. Towsley, “Incentive and Reputation Mechanisms for Crowdsourcing Systems,” in *2015 IEEE 23rd International Symposium on Quality of Service (IWQoS)*, 2015, pp. 207–212.
- [10] Y. Wang, Z. Cai, G. Yin, Y. Gao, X. Tong, and G. Wu, “An incentive mechanism with privacy protection in mobile crowdsourcing systems,” *Comput. Networks*, vol. 102, pp. 157–171, 2016.
- [11] J. Sun and H. Ma, “Privacy-preserving verifiable incentive mechanism for online crowdsourcing markets,” in *Proceedings - 23rd International Conference on Computer Communications and Networks, ICCCN*, 2014, pp. 1–8.
- [12] H. Yu, C. Miao, B. An, Z. Shen, and C. Leung, “Reputation-aware task allocation for human trustees,” in *Proceedings of the 2014 international conference on Autonomous agents and multi-agent systems*, 2014, pp. 357–364.
- [13] F. Hendriks, K. Bubendorfer, and R. Chard, “Reputation systems: A survey and taxonomy,” *J. Parallel Distrib. Comput.*, vol. 75, pp. 184–197, 2015.
- [14] S. Jagabathula, L. Subramanian, and A. Venkataraman, “Reputation-based Worker Filtering in Crowdsourcing,” in *Advances in Neural Information Processing Systems 27*, 2014, pp. 1–9.
- [15] Y. Zhang and M. Van Der Schaar, “Reputation-based Incentive Protocols in Crowdsourcing Applications,” in *Proceedings - IEEE INFOCOM*, 2012, pp. 2140–2148.