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ICCMSO 2025

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Message from the General Chair

ICCMSO 2025

It is my honor and a true opportunity being the General Chair of the present conference to invite all the delegates/speakers for attending the 4th series of the International Conference on Computational Modelling, Simulation and Optimization (ICCMSO-2025) which is going to held during 20 – 22 June 2025 at Singapore in a Hybrid Mode. It's a great achievement of the ICCMSO-2025 that the delegates from the different parts of the world including India, Vietnam, Philippines, USA, Austria, UAE, Indonesia, Malaysia, China, UK, Bulgaria, Australia, Poland contributed in this international event.

This international conference is jointly organized by Sampoerna University Indonesia, Lakireddy Bali Reddy College of Engineering, Andhra Pradesh, India and Innovative Research Foundation. It is intended to be one of the initial attempts towards a superior conference on Computational Modelling, Simulation and Optimization with its application in different research area(s) and domain(s).

I believe that the present conference will provide novel opportunities for sharing and exchanging original research ideas and opinions, gaining inspiration for future research, and broadening knowledge about various fields.

All the papers included in the conference schedule were selected after the peer review process and I am thankful to our publication partner IEEE CS CPS for agreeing to publish the Conference proceedings.

I also want to express our sincere appreciation to the members of the organizing Committee for their critical review of the submitted papers, as well as the time and energy devoted to editing the proceedings and arranging the logistics as well as IT support for holding this conference. I would also like to give appreciation to the authors who have submitted their excellent works to this conference.

Lastly, I also heartily thank the reviewers for spending their valuable time and energy while selecting the best articles for the proceeding.

Therefore, whether you are looking to challenge yourself intellectually, immerse yourself in the latest technological developments, or to simply reconnect with friends and colleagues, get ready to attend a great conference, and to enjoy Lion and Garden City Singapore during the conference.

General Chair
Ashwani Kumar Dhingra, *Maharshi Dayanand University Haryana; Innovative Research Foundation, India*

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Message from the Organizing Secretary

ICCMSO 2025

It gives us utmost pleasure for welcome you all to the ICCMSO-2025 which is being held at Shaw Foundation Alumni House, Singapore in a Hybrid Mode during 20-22 June 2025. Singapore is an Island country and also known as Lion City or Garden City.

One year ago when we were entrusted with the task of organizing this conference, we were very thrilled and excited. But down the road we faced many hurdles and problems. However, with the support of our team and advisers we will be able to sail through this journey and we are hopeful that we would be able to meet the expectations of our esteemed guests and delegates.

The Organizing Committee has worked really hard to make this conference a huge success. The Scientific Technical program covered a wide spectrum of topic including the Keynote, Plenary/Invited Speaker in the thrust areas of the advancement in Engineering, Science and Technology which provide the right mix to enlighten you all with the latest development in application areas of computational modelling, simulation and optimization.

We hope that you will return with sweet memories of this Conference and wish to attend this event again.

We the members of Organizing Committee of ICCMSO-2025 Singapore are eagerly waiting your arrival and wish you a Successful, enjoyable & memorable Conference.

Organizing Secretary
Manish Kumar, *BayWa r.e. (Thailand) Co. Ltd., Thailand*

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Message from the Program Chairs

ICCMSO 2025

We, on behalf of ICCMSO-2025 organizing Committee, heartily welcome all the Guest(s), Speaker(s), Session Chair(s) and Delegates to the 4th International Conference on Computational Modelling, Simulation and Optimization (ICCMSO-2025) during 20 – 22 June 2025 at Singapore which is being organized by Innovative Research Foundation (IRF) in collaboration with Sampoerna University, South Jakarta Indonesia and Lakireddy Bali Reddy College of Engineering, Andhra Pradesh, India.

This conference allows both researchers and practitioners to present and share their on-going ideas, experiences, and research results in the application areas of Computational Modelling, Simulation and Optimization. The technical program includes the careful selection of interesting and novel research papers/Abstracts for presentation during the three-day conference.

Out of the received papers from authors of different parts of the continent, 69 full length papers have been accepted and registered for inclusion in the conference proceedings along with 06 Abstracts to be presented in the different onsite/online technical sessions of this Conference.

The submissions cover a wide range of themes which include theory, methods, and applications related to the computational Modelling, simulation and Optimization.

We expect that the deliberations during the conference will enrich academic wisdom of the participants to enable exploration of new domains of applications in ICCMSO-2025.

We hope the delegates will surely enjoy the conference and have a memorable and fruitful experience at Singapore and wish for the great success of the conference.

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Message from the Conference Chairs

ICCMSO 2025

It is our distinct honor and privilege to welcome all the Guest(s), Speaker(s), Session Chair(s), Participants, Delegates during the 4th series of the ICCMSO-2025: International Conference on Computational Modelling, Simulation and Optimization which takes place during 20 – 22 June 2025 at Singapore which is organized by Innovative Research Foundation (IRF) along with joint collaboration with Sampoerna University, South Jakarta Indonesia and Lakireddy Bali Reddy College of Engineering, Andhra Pradesh, India.

This conference allows both researchers and practitioners to present and share their on-going ideas, experiences, and research results in the application areas of Computational Modelling, Simulation and Optimization. The careful selection of interesting and novel research papers/Abstracts have been included in the conference run down for presentation during the three-day conference.

During the three days, we have an exciting lineup of keynote, Plenary, invited speakers and networking opportunities designed to stimulate thought-provoking discussions, foster collaborations, and inspire innovative solutions. We encourage each of you to actively participate and contribute to the vibrant exchange of ideas.

We would like to express our appreciation to the whole organizing committee including the General Chair, Organizing Secretary, Program Chair, Conference Chair(s) and Editors, Program/Advisory Committee and secondary reviewers who contributed a great amount of their time and effort to evaluate the submissions to maintain high quality of the conference.

We also thank the local arrangement committee; the finance chairs; the session chairs who presided over the sessions; and all the authors, attendees, and presenters who really made this conference possible and successful.

Thank you once again for your presence and participation. We are confident that this conference will be a facilitator for innovative discoveries and transformative ideas that will enhance the quality of the ongoing research in the area of Computational Modelling, Simulation and Optimization.

Wishing you all memorable experience and stay at Singapore.

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Filscha Nurprihatin, *Sampoerna University, Indonesia*
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A Comparative Analysis of Classification Performance between Balanced and Imbalanced Rodent Tuber Datasets using Support Vector Machine and Random Forest

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Abstract— **The main discussion in this paper is focused on how the condition of a dataset (imbalanced or balanced) can affect classification results. The dataset used in this study is Rodent Tuber's imbalanced dataset, which contain chemical information that can be used for cancer identification. This dataset will be classified using Support Vector Machine with 4 kernels and Random Forest. Classification is performed on both an imbalanced and balanced dataset by Cluster Centroid Undersampling to observe the differences. The results show that a balanced dataset yields better outcomes with minimal running time. The best results from classification on the balanced dataset were obtained using the Random Forest algorithm.**

Keywords— Rodent Tuber, Classification, Support Vector Machine, Random Forest, Balanced and Imbalanced Data, Cluster Centroid Undersampling

I. INTRODUCTION

Numerous genetic and epigenetic variations contribute to the complexity and multifaceted nature of cancer [1]. Breast cancer is one of these variants. The number of breast cancer-related deaths increases dramatically every year. It is the most prevalent kind of cancer and the world's greatest cause of death among women [2]. As stated in [3], traditional medicine, which incorporates Chinese medicine and natural remedies, is one approach that can be utilized to treat this.

Typhonium flagelliforme, often known as Rodent Tuber, is a native herbal plant of Indonesia that can be found in several other nations, such as Australia, India, and Sri Lanka [4]. In medical practices, its historical use as an anticancer treatment has drawn interest. This plant has been used to treat cancers of the cervix, prostate gland, lungs, breasts, liver, leukemia, and intestines [5]. Furthermore, in the context of investigating the potential of traditional herbal treatments like Rodent Tuber to treat cancer, it is imperative to comprehend the difficulties presented by unbalanced datasets in machine learning.

If there is a significant difference in the frequency of class instances between multi-class and binary datasets, with some classes being significantly more common than others, the dataset is deemed to be unbalanced [6], [7]. This imbalance affects machine learning algorithms since the majority class is typically given preference, which lowers the accuracy for the minority class [8], [9]. When there are binary imbalances, the skewed distribution of data frequencies across classes leads to differing prior probabilities and thus, a bias towards the dominant class during training. Situations with multiple classes make this issue worse. Generally speaking, machine learning algorithms have trouble effectively representing and classifying data in imbalanced datasets [10], [11].

This paper is organized into several sections. Section 1 consists of the introduction and background of this research; Section 2 consists of research studies related to Rodent Tuber and algorithms that were used; Section 3 shows the design of the methodology of the research; Section 4 is the results of this research; and Section 5 is a conclusion that consists of several important points.

II. LITERATURE REVIEW

The Rodent Tuber dataset has been studied in the past in a number of studies. The identification of the Rodent Tuber plant is covered in these publications [12], [13], [14], [15]. The outcomes of these identifications can help with the creation of Random Forest and Support Vector Machine, two types of machine learning models. ‘

Numerous research have made extensive use of the Random Forest and Support Vector Machine methods [16], [17], [18], [19]. As shown in [16], these techniques are used for document classification. In addition, phishing detection [17], credit card fraud detection [18], and brain cancer diagnosis [19] all make use of Support Vector Machine and Random Forest.

Random Forest was not as accurate as Support Vector Machine in the document classification example [16]. Support Vector Machine performed better than Random Forest in phishing detection [17], with an accuracy of 97.451% as

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opposed to Random Forest's 97.369%. In a similar vein, Support Vector Machine outperformed Random Forest with an accuracy of 98% in credit card fraud detection [18]. In terms of brain cancer detection [19], Naïve Bayes achieved the highest F-score of 99%, followed by Support Vector Machine at 98.7% and Random Forest at 98%.

III. RESEARCH METHOD

To help with a thorough comprehension of the research methodology, we provides a graphic summary of the method as shown as Figure 1.

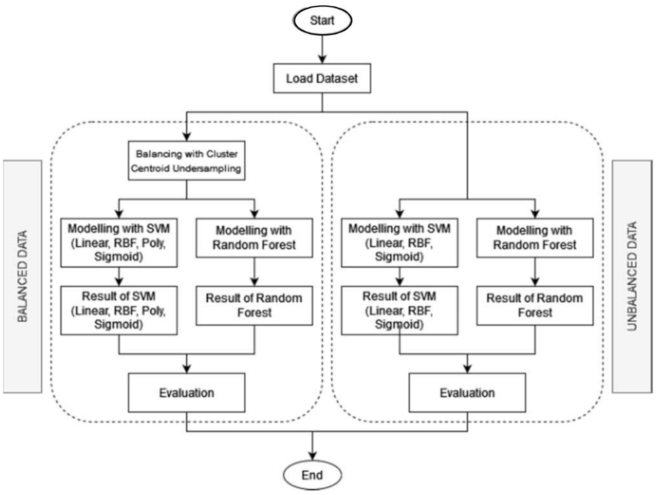

Fig. 1. Research Method

The dataset used in this study is the Rodent Tuber dataset, consisting of 4 columns and approximately 663,228 rows. After calculating to determine whether the dataset is imbalanced or balanced, we found that the Rodent Tuber dataset is imbalanced, with a ratio of 98 to 2 between target 0 and target 1, comprising approximately 653,398 data points for target 0 and 9,830 for target 1, as shown in Figure 2.

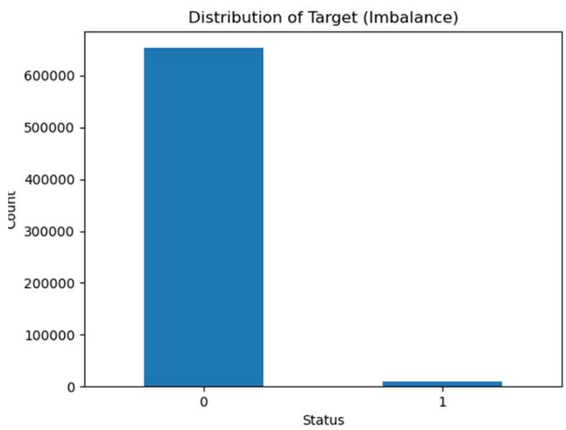

Fig. 2. Distribution of Targets on an Imbalanced Dataset

Due to the significant imbalance in the dataset, balancing will be performed to ensure accurate classification results. In this research, the algorithm used for balancing the dataset is Cluster Centroid Undersampling. Undersampling balances the dataset by reducing the majority class to match the minority class. After the balancing process was completed, the results can be seen in Figure 3.

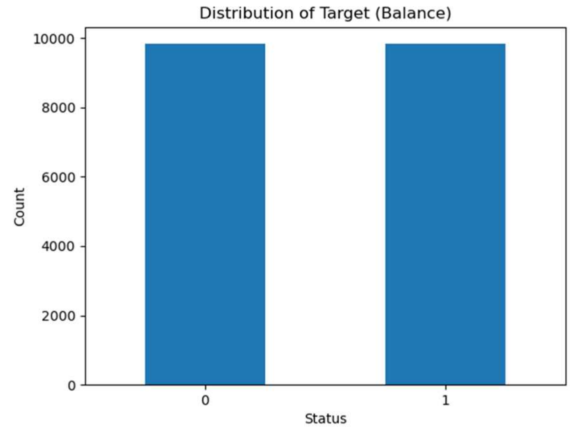

Fig. 3. Distribution of Targets on a Balanced Dataset

This study utilizes various classification algorithms, such as Support Vector Machine with four different kernels (linear, RBF, sigmoid, and poly), as well as Random Forest. These algorithms will be applied to datasets with both imbalanced and balanced distributions. The primary aim is to assess how the dataset's condition (imbalanced or balanced) influences the classification results for the Rodent Tuber dataset.

In the Support Vector Machine algorithm, all kernels will use default parameters, and specific parameter settings will not be explicitly stated in the code. Similarly, for the Random Forest algorithm, default parameters will be used or not explicitly mentioned in the code. Table 1 provides an overview of the default parameters used in the code if parameters are specified explicitly.

TABLE I. THE PARAMETERS OF THE CLASSIFICATION ALGORITHMS

No.	Classification Algorithm	Parameter
1	SVM (Linear Kernel)	C=1.0, tol=1e-3
2	SVM (RBF Kernel)	C=1.0, gamma='scale'
3	SVM (Sigmoid Kernel)	C=1.0, gamma='scale', coef0=0.0
4	SVM (Poly Kernel)	degree=3
5	Random Forest	n_estimators=100

The device used for this study is a laptop with the following specifications:

a. CPU: Intel® Core™ i5-11400H Processor with 6 cores and 12 threads.

b. RAM: 16GB dual-channel DDR4 SODIMM at 3200MHz.

c. Operating System: Windows 11 Home 64-bit version 23H2.

d. Experiment and program execution: Jupyter Notebook version 6.4.12, Python version 3.9.13, and scikit-learn package version 1.0.2.

IV. Results and Discussions

Due to the highly unbalanced nature of the dataset, with a ratio of approximately 98:2 between target 0 and 1, it is necessary to balance the dataset. Balancing is achieved by employing Cluster Centroid Undersampling, resulting in a reduced dataset, as shown in Figure 3. The result of the undersampling performed is a new dataset with a ratio of 1:1 between target 0 and 1, comprising approximately 9,830 data points for target 0 and 9,830 for target 1.

The data obtained from the confusion matrix can be used to calculate various metrics that measure the quality of classification results. The metrics that can be computed from the confusion matrix are Accuracy, Precision, Recall, and F1 Score.

The results of the confusion matrix for each classification algorithm on both the imbalanced and balanced datasets, along with the computed values of accuracy, precision, recall, and F1 score, can be viewed in Table 2. Additionally, the table includes the time in seconds, indicating the duration of the program executing the algorithms with both balanced and imbalanced datasets.

TABLE II. The Evaluation Metric Score of Classification Algorithms for An Imbalanced and Balanced Dataset

Balancing Method	**Classification Method**	**Evaluation Metric**				
		Precision	***Recall***	***F1 Score***	***Accuracy***	***Time (Seconds)***
None (Imbalanced)	SVM (Linear)	0.000	0.000	0.000	0.985	419.031
	SVM (RBF)	0.000	0.000	0.000	0.985	875.406
	SVM (Sigmoid)	0.012	0.012	0.012	0.971	5264.386
	SVM (Poly)	Incomplete	Incomplete	Incomplete	Incomplete	Incomplete
	Random Forest	1.000	0.999	0.999	0.999	67.652
Cluster Centroid Undersampling	SVM (Linear)	0.603	0.965	0.742	0.670	7.342
	SVM (RBF)	0.693	0.820	0.751	0.732	9.498
	SVM (Sigmoid)	0.571	0.575	0.573	0.578	8.823
	SVM (Poly)	0.701	0.415	0.521	0.625	8.231
	Random Forest	0.969	0.994	0.981	0.981	1.649

The experiment results for the imbalanced dataset show poor performance and longer running times compared to classification on balanced datasets. In one kernel of the Support Vector Machine algorithm, namely "Poly," the required running time to complete the program was extremely long. After running the program for more than 24 hours, it was forcibly terminated as the algorithm was deemed highly ineffective and inefficient for the imbalanced dataset, resulting in the experiment being labeled as "Incomplete." Support Vector Machine on imbalanced data produces a high accuracy, but with a very low, even zero f1-score and takes time. This shows that Support Vector Machine is not suitable for use on imbalanced data.

The best results from classification using Support Vector Machine and Random Forest for both Imbalanced and Balanced datasets were obtained with the Random Forest algorithm using the balanced dataset. The results from the experiment are as follows: Accuracy of 0.981 or 98%, Precision of 0.969 or 96%, Recall of 0.994 or 99%, F1 Score of 0.981 or 98%, with a total running time of 1.649 seconds.

One of the best classification results, if only considering the numbers, is Random Forest for the Imbalanced dataset, with an Accuracy of 0.999 or 99%, Precision of 1.000 or 100%, Recall of 0.999 or 99%, F1 Score of 0.999 or 99%, and a total running time of 67.652 seconds. However, focusing solely on the numbers may raise suspicions of overfitting due to the extremely imbalanced dataset, resulting in less reliable outcomes.

Random Forest tends to perform better in handling imbalanced data, where the minority class may not be well represented. By using techniques such as 'bootstrapping' and 'random sampling' in tree construction, Random Forest can be more effective in handling rare classes. SVM, especially without proper parameter tuning (such as assigning more weight to the minority class), may struggle with imbalanced data.

Compared to SVM, Random Forest is more effective at handling larger datasets. Because SVM's computational complexity can increase exponentially with data size, it takes a long time to train a model on large datasets, particularly when dealing with complex kernels. However, Random Forest, a decision tree-based technique, can divide the information into numerous subgroups concurrently, enabling quicker training.

V. Conclusions

From the classification experiment results using Support Vector Machine and Random Forest on both imbalanced and balanced datasets, it's evident that classification with an imbalanced dataset (particularly with extremely imbalance) can significantly impact the quality of classification outcomes, whether using Support Vector Machine or Random Forest.

Therefore, this research demonstrates that Random Forest outperforms other algorithm which is Support Vector Machine in accuracy, precision, recall, F1 score, and execution time, and is capable of handling imbalanced datasets, despite concerns about potential overfitting.

We also conclude that balancing the dataset is crucial, especially for datasets with high levels of imbalance. Imbalance in the dataset can lead to ineffective and inefficient execution of classification algorithms, resulting in poor outputs.

It is recommended to use other data balancing methods, such as the over-sampling balancing method in future research to assess the performance of these algorithms.

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