Kristina P. Sinaga

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SUMMARY

I hold a PhD in applied mathematics from Chung Yuan Christian University, Taiwan. During my PhD, I worked on the development of single-view and multi-view clustering algorithms based on mathematical formulations. Specifically, I work on five areas: optimization, feature reduction, data analysis, parameter analysis, and competitive robustness. More recently, I am developing multi-view k-means and fuzzy c-means clustering in federated settings. My experience in programming languages such as Matlab and Python, coupled with my proficiency in optimization and designing new algorithms, has enabled me to tackle various analytical challenges effectively. My research in unsupervised learning & pattern recognition is internationally recognized through my 6+ publications, reviewers roles in international conferences and journals. For the last four years I have been a specialist lecturer - S3 (S3 is equivalent to PhD) in the information systems management department at BINUS university, Indonesia (2020-2022) and postdoc in the applied mathematics department at Chung Yuan Christian University, Taiwan (2023-2024).

PROFESSIONAL EXPERIENCE

Post-doctorate Fellow
Department of Applied Mathematics, CYCU, Taiwan **Mar. 2023 – Mar. 2024**

- Primarily works in an office environment and working from home using personal PC for much of the day.
- Work independently and weekly meeting with PI to discuss a new idea or new accomplishment related to the research works.
- Proposed a new objective function of soft and hard clustering to address multiple resources, clients or users data.
- Designed new algorithms of multi-view k-means (MVKM) and multi-view fuzzy c-means (MVFCM) in non-federated and federated environments.
- Provided (Matlab) codes for the problems of multiple resources and multiple clients or users data.
- Conducted experiment/simulation on different publicly available multi-view data sets and interpret the results.
- Wrote academic papers that implemented a soft or hard clustering algorithm to assure efficiency, repeatability, and standardization in the use of multiple-resources data over multiple clients or users.
- Served as a reviewer of IEEE Access.

Lecturer Specialist - S3
Information Systems Management Department, **Nov. 2020 – Mar. 2022**
BINUS Graduate Program, Indonesia

- As a lecturer my role, is to teach, do research, serve communities in Indonesian society, provide and grading students examinations/their other assessment items. I also got the opportunity of contributing to and developing the course content, homeworks, exams and programming assignments.

Staff (Badge: Supervisor)
BINUS University, Indonesia **Nov. 2020 – Mar. 2022**

- As a staff my role, is to advance the university by participating and contributing in any tasks related to the binus graduate program of master of management of system information.

EDUCATION

Doctor of Philosophy, Applied Mathematics
Chung Yuan Christian University (CYCU), Taiwan 2020
Thesis title: *Multi-view fuzzy clustering algorithms for multi-view data*
Thesis' PPT: *Click here*
CGPA: 3.842 out of 4.000

Master of Science, Mathematics in Operation Research
University of Sumatera Utara (USU), Indonesia 2015
CGPA: 3.78 out of 4.000

Bachelor of Science, Mathematics in Statistics
University of Sumatera Utara (USU), Indonesia 2013
CGPA: 3.30 out of 4.000

RESEARCH SUMMARY

Research Interests

- Clustering: I developed k-means and fuzzy c-means (FCM) algorithms to handle single-view and multi-view data. I occasionally build new clustering algorithms that are based on the goals of the mathematical formulation. Prior to that, I also made available and publicly shared the code of my proposed algorithm on my GitHub page. Recently, I leveraged my research interests into graph clustering, manifold regularizations, and kernel-based approaches to separate data points into different clusters.
- Pattern Recognition: I work on clustering based algorithms like k-means and FCM for dimensionality reduction. I facilitate the principal analysis of undesirable, unlikely, and relevant features phenomena on single and multi-view data. Specifically, I created a collaborative approach to select informative features with single/multi-view feature representation and unsupervised learning. In such a way, applying this feature selection-based dimensionality reduction technique can effectively provide the optimal number of clusters k but also improve the accuracy significantly.
- Federated Learning: Currently, I am working on federated learning (FL), developing and designing a conventional multi-view clustering algorithm into a parallel algorithm for mathematical optimization in recognizing data patterns from multi-view data of multiple clients. Unlike my previous works on non-federated unsupervised machine learning techniques, in this topic, I organize and present a creative/innovative perspective by proposing a new algorithmic approach to handle multiple clients' multi-view data with privacy and effective communication concerns.

HONORS & AWARDS

Honorary Member
The Phi Tau Phi Scholastic Honor Society of The Republic of China, CYCU, Taiwan 2020

Recipient
Japan Science and Technology Agency (JST), Niigata University, Japan 2018

Recipient
Japan Student Service Organization (JASSO), Niigata University, Japan 2017

Recipient
CYCU International Student Scholarship, CYCU, Taiwan 2016

PROFESSIONAL ACTIVITIES

Journals Reviews

- Information Fusion, Elsevier (2022 – 2023).
- IEEE Access (2021 –2023)
- Applied Soft Computing, Elsevier (2022).
- IEEE TKDE (2022)

Conference Reviews

- IJCNN2023.
- WCCI2022.

TEACHING EXPERIENCE

In my modules, I have taught over 80 undergraduate students, and over 100 graduate students (regular and online programs). In total, I have taught over 180 unique students. I moderated some events such as guest lecturer events (participated by undergraduate, graduate, doctorate students, lecturer, etc. from different university in-and-abroad). In total, I have moderated 4 events with uniques attendances from Indonesia and abroad (2020 - 2021).

Masters in Information Systems Management

- Regular and online program of Business Intelligence and Analytics (2020 - 2022)

Bachelors in Computer Science

- Calculus I (2021)
- Discrete Mathematics (2021 - 2022)

PROFESSIONAL MEMBERSHIPS

Member, The Institute of Electrical and Electronics Engineers (IEEE)	[2020 – 2021]
Member, IEEE CIS	[2020 – 2021]
Member, IEEE SPS	[2020 – 2021]
Scientific Committee Member, World Academy of Science, Engineering and Technology (WASET), category of Mathematical and Computational Sciences	[2020 – 2021]

CERTIFICATION

The Data Scientist's Toolbox
Johns Hopkins University — Coursera — Nov 30, 2022
Instructor: Jeff Leek, PhD, Roger Peng, PhD, and Brian Caffo, PhD

Python Project for Data Science
IBM — Coursera — Nov 25, 2022
Instructor: Azim Hirjani & Joseph Santarcangelo

Python for Data Science, AI & Development
IBM — Coursera — Nov 24, 2022
Instructor: Joseph Santarcangelo

Tools for Data Science
IBM — Coursera — Nov 22, 2022
Instructor: Aije Egwaikhide, Svetlana Levitan, and Romeo Kienzler

Deep Learning.AI TensorFlow Developer
DeepLearning.AI — Coursera — Nov 15, 2022
Instructor: Laurence Moroney

Neural Networks and Deep Learning
DeepLearning.AI — Coursera — Nov 5, 2022
Instructor: Andrew Ng, Kian Katanforoosh, and Younes Bensouda Mourri

Machine Learning Specialization
DeepLearning.AI — Stanford University — Coursera — Oct 26, 2022
Instructor: Andrew Ng

Advanced Learning Algorithms
DeepLearning.AI — Stanford University — Coursera — Oct 26, 2022
Instructor: Andrew Ng

Understanding and Visualizing Data with Python
University of Michigan — Coursera — Oct 18, 2022
Instructor: Brenda Gunderson, Ph.D., Kerby Shedden, Ph.D., and Brady T. West, Ph.D.

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PUBLICATIONS

According to Google Scholar Citations, my h-index is **5** and I have over **1,500** citations.

My top cited publication (with over 1000 citations) is: "Unsupervised k-means clustering algorithm" (with over 1,330 citations). My top second publication (with over 100 citations) is: "A feature-reduction multi-view k-means clustering algorithm" (cited by 116). My top third cited publications (with over 20 citations) are: "Collaborative feature-weighted multi-view fuzzy c-means clustering" (cited by 49); "Entropy k-means clustering with feature reduction under unknown number of clusters" (cited by 33). My top fourth cited publications are: "Poverty data modeling in North Sumatera Province using geographically weighted regression (GWR) method (cited by 7)"; "Unsupervised multi-view fuzzy c-means clustering algorithm (cited by 3)"; "Modified relational mountain clustering method (cited by 3)", "Spatial variation in infant mortality with geographically weighted poisson regression (GWPR) approach (cited by 3)"; "Machine learning approaches for marketing campaign in Portuguese banks (cited by 2)".

Journal Paper

1. Hussain, Ishtiaq, **Sinaga, Kristina P**, and Yang, Miin-Shen (2023). Unsupervised multi-view fuzzy c-means clustering algorithm. *Electronics*, *12*, 4467.

2. Yang, Miin-Shen and **Sinaga, Kristina P** (2021). Collaborative feature-weighted multi-view fuzzy c-means clustering. *Pattern Recognition*, *119*, 108064.

3. **Sinaga, Kristina P**, Hussain, Ishtiaq, and Yang, Miin-Shen (2021). Entropy k-means clustering with feature reduction under unknown number of clusters. *IEEE Access*, *9*, 67736–67751.

4. **Sinaga, Kristina P** and and Yang, Miin-Shen (2020). Unsupervised k-means clustering algorithm. *IEEE Access*, *8*, 80716–80727.

5. Yang, Miin-Shen and **Sinaga, Kristina P** (2019). A feature-reduction multi-view k-means clustering algorithm. *IEEE Access*, *7*, 114472–114486.

6. **Sinaga, Kristina P** and Hutahaean, Manuntun and Gea, Petrus (2016). Spatial Variation in Infant Mortality with Geographically Weighted Poisson Regression (GWPR) Approach. *International Journal of Science and Research*, *5*(3), 96–100.

7. **Sinaga, Kristina P**(2015). Poverty Data Modeling in North Sumatera Province Using Geographically Weighted Regression (GWR) Method. *International Journal of Science and Research*, *4*(2), 1738–1742.

Conference Paper

1. A. Jennifer and **Sinaga, Kristina P**(2021). Machine learning approaches for marketing campaign in Portuguese banks. *2021 3rd International Conference on Cybernetics and Intelligent System (ICORIS)*, Makasar, Indonesia, 1–6.

2. W. Henwy and **Sinaga, Kristina P**(2021). Telecommunication analytics based on customer segmentation using unsupervised algorithms. *2021 3rd International Conference on Cybernetics and Intelligent System (ICORIS)*, Makasar, Indonesia, 1–6.

Book Chapter

1. D. Yuniati and **Sinaga, Kristina P**(2021). Analytics-based on classification and clustering methods for local community empowerment in Indonesia. *(eds) Soft Computing in Data Science, SCDS 2021*, *Communication in Computer and Information Science*, *vol. 1489*, Springer, Singapore.

2. **Sinaga, Kristina P**, Benjamin, J.B.M., and Yang, Miin-Shen (2018). Modified relational mountain clustering method. *Artificial Intelligence and Soft Computing: 17th International Conference, ICAISC 2018*, Zakopane, Poland, June 3-7, *Part I 17*, 690–701.

Under Review

1. Yang, Miin-Shen and **Sinaga, Kristina P** (2024). Federated multi-view k-means clustering. **(Submitted to IEEE TPAMI)**

In Manuscript

1. Yang, Miin-Shen and **Sinaga, Kristina P** (2024). Federated weighted multi-view fuzzy c-means.

2. **Sinaga, Kristina P** and Yang, Miin-Shen (2024). A globally collaborative multi-view k-means clustering.

3. **Sinaga, Kristina P** (2024). Rectified Gaussian kernel multi-view k-means clustering.

4. Yang, Miin-Shen, Josephine. B.M. Benjamin, **Sinaga, Kristina P** (2024). A survey of soft clustering.

5. **Sinaga, Kristina P** (2024). Personalized federated learning under collaborative multi-view k-means clustering.

6. **Sinaga, Kristina P** (2024). Tensor k-means clustering algorithm.

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References

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