Research Statement

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Background

My research revolves around learning analytics, text analysis and mining, and digital business. The first and main focus is to enhance models, algorithms and frameworks related to opinion mining & analytics, information retrieval and extraction, and digital business. I have been working on several problems related to the above three areas with solutions that benefit the general research problems related to opinion mining, entity extraction, and information retrieval.

Second, I apply my research findings and outcomes to research problems related to education, software systems, digital business and mobile applications. These research communities work with large unstructured data and needs principled methodologies that can aid in converting unstructured data into human and machine usable forms. My works on these areas provide such domain-specific data and text mining solutions. My main focus currently is towards the applying analytics in education and digital business fields.

For past ten years, I have been working actively in the education technology, AI for education, digital business, text mining applications, industry AI applications and user behaviour areas.

Research Areas

Figure 1 depicts the two key areas of my research; education technology and digital business. I have been actively participating in the research in both these areas and published several works in top journals and conferences.

Research Areas	
Education	**Digital Business**
• Information Systems Education • Technology for teaching • AI for Education	• Process Innovation • Analytics in Digital Business • AI and Machine Learning for Digitalization

Figure 1: Overview of my key research areas

Information Systems Education

With the new digital technologies rapidly taking over the industry, it is crucial to prepare the students with the necessary skills in information Systems. The research in IS education is becoming more important to understand how learning and teaching the content is construed. This involves understanding the curriculum aspects, job models, teaching models and modes, etc. We studied the job descriptions related to IS, curriculum aspects such as courses and content designs and work study programs for IS students and their impact on learning and jobs. We also studied the need for new teaching models for IS students for effective learning.

Impact: Share the education research in the IS communities (AMCIS, ISIS – SIGED, EDUCON) where we present the new curriculum designs and IS education findings. We also publish papers in these top conferences which helps bring reputation to SMU education.

Innovation in teaching is crucial to have effective learning for new generation students. This involves innovation in both the curriculum design and course design and delivery. In particular, I work with the teaching approaches such as experiential learning, integrated project learning, min-case pedagogy, design thinking etc.

Impact: I work with SMU-X team to implement the experiential learning in undergraduate courses. I also share my teaching innovation with external researchers. For example, I work with AIS and APSEC societies which are active in IS and computers related research and pedagogy works. This is enable to build the network and enhance the reputation of SIS and SMU. To enable such collaborations, not only I publish my research works but also run tutorials and workshops in the conferences organized by these societies

Technology for Teaching

Discussions, either live classroom or through online forums, when used as a teaching method can help stimulate critical thinking. It allows the teacher to explore in-depth the key concepts covered in the course, motivates students to articulate their ideas clearly and challenge the students to think more deeply. Analysing the discussions helps instructors gain better insights on the personal and collaborative learning behaviour of students. However, knowledge from in-class discussions and online forums is not effectively captured and mined due to lack of appropriate automated tools. In this paper, the authors propose an automated discussion analysis (ADA) framework that provides a starting point providing guidance on the development of automated tools for performing different analysis on live classroom or online discussions. AI technology plays a key role in developing tools for

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knowledge representation and analysis. We propose software systems based on ADA framework and AI technology.

Impact: We did a case study where one model of the ADA framework, individual behaviour analysis model, has been applied to automate the analysis of the online discussion forum used in a postgraduate course. We also published papers in ICEE (Best paper nominee) which analyses the social networks and learning process in a classroom.

Learning analytics deals with the development of methods that harness educational data sets to support the learning process. In this area, I work on various education dimensions such as curriculum, teaching, industry and students. We proposed a generic curriculum analytics framework that can act as a useful guide for understanding the key dimensions that have to be considered when applying analytics in curriculum analysis and evaluation. The aspects are around analyzing, evaluating and discovering gaps.

Impact: Our research outcomes are recognized by the education community as a new direction and received positive feedback during the conference presentations. I am working with Center of Teaching Excellence (CTE) for applying learning analytics in SMU environment. In particular, I am working closely on student evaluations and the automated analysis of data to discover insights.

Technology in teaching

Technology is integral part of modern education system. Using technology of teaching process is an important research area that enables effective teaching and learning process. In this area, I work on how mobile technology can be used in the classroom delivery process. In particular, I work on LiveClass project which aims at capturing in-class discussions using mobile apps and analyse the discussions for discovering insights using text analytics approach. Currently, I am working on research related to immersive technologies for the classroom learning and training (published paper in TALE).

Impact: I Work closely with CTE and TEL committee in SMU to promote the tools developed as a part of my education research. For example, student feedback analysis tool and LiveClass tools are recognized as SMU TEL tools and CTE is sponsoring for the extension of Live class project.

AI in Teaching

AI has been increasingly used in assessments across various fields due to its ability to efficiently evaluate, analyze, and provide insights. For example. AI can assess an individual's skills and knowledge in various domains, providing personalized learning paths or training recommendations based on the assessment results. Computer science students face challenges in developing advanced programming skills. AI technologies such as AI chatbots are very useful in mentoring the students and preparing them with advanced programming skills.

Impact: My recent research is based on ChatGPT for education and analysing the impact of using AI generative tools in the classroom for project mentoring and programming skills development. I published papers in the ICCE and AMCIS to share the experiences of AI tools in computing courses.

AI ethics in education is a critical topic that involves ensuring responsible and ethical use of artificial intelligence technologies within educational settings. Algorithms should be developed and trained with diverse and representative datasets to avoid discrimination. Educational AI systems should be transparent in their operations and decisions. They need to prioritize data privacy and security when collecting, storing, and using student or teacher data.

Impact: Working closely with CTE on the frameworks for the AI in assessments. Analysed various AI detection tools, and prepared framework for SMU schools.

Digital Business

Customers are increasingly using technology to initiate interactions with companies on their own terms. IT leaders should follow these best practices to enable their organizations to keep up with the pace of change customers are driving in the digital business world. For a successful digital business transformation, they must develop digital business principles, a digital business blueprint and a digital business execution plan. To fuel the digital business of the future, incorporating this data from digital channels and devices into a central customer profile is essential. A digital business needs to have descriptive, diagnostics analytics, predictive and prescriptive analytics for decision making process in daily business operations. I study the research problem of devising frameworks for embedding analytics in to business processes.

Impact: In digital business research, we proposed "Analytics Driven Business Process Improvement (ADBPI) Framework" that provides a structure for how an organization can examine its current business process and enhance this process by embedding analytics within the process and presented at IS conferences. At

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the same, time we also incorporated this concept into SIS curriculum through PMSB course. The class content delivery and aspects are shared with Information Systems educationists in pre-ISIS conference. It has been well received and the academicians are looking forward for teaching cases and projects in this area. We even run some tutorials for academicians on this framework. I have worked with SMU- IITS team to implement the AI based Scholarship Management System to streamline the scholarship process in SMU.

User Profiling

Users' comments on political issues or technical forums and their social network together aid in detecting users profile data such as gender, age, political affiliation, technical interests, and ideological beliefs. Such information benefits recommendation systems and advertising applications. Predicting political party affiliation is useful for election campaigning, target advertising or even vote prediction applications.

Impact: This study was extended in the education field for profiling the stakeholders – particularly the students. We studied the linked in profiles and competencies of students to profile the students and recommend the job roles. We studied the cognitive behavior of students to analyse the interactions and the correlations with student learning.

Content Mining for Insights and patterns

Content mining is the scanning and mining of text, pictures and graphs of a Web page to determine the relevance of the content to the search query. Web content mining refers to the large-scale of information extraction from a target content. In particular, I study the techniques needed for mining text and images for Wikipedia. We applied the models to educational datasets to mine students' wiki project pages. The outputs to the projects are insights about the projects and recommendation systems for faculty management.

Impact: Extending this work to education datasets to analyse the students' comments which are textual in nature can provide useful insights to faculty to discover the strengths and weakness of the courses. Similarly, analyzing users' feedback on library services provides insights and actionable knowledge to university management. This research is directly studied in the SMU environment.

Selected Publications and Outputs

1. Learning Web Programming: Identifying Complex Topics from Student Discussion Forums and Lecture Slides
S Gottipati, KJ Shim, R Tan, ZR Tan
2023 IEEE Global Engineering Education Conference (EDUCON), 1-8, 2023

2. AI for Connectivism Learning-Undergraduate Students' Experiences of ChatGPT in Advanced Programming Courses
S Gottipati, KJ Shim, V Shankararaman –
DP FIV 5356 Surfhhglrjv14912023

3. Machine Learning based Financial Aid Management Process
S Gottipati, V Shankararaman, KC Rao, V Vetrivillalan
DP FIV 5356 Surfhhglrjv1491

4. Analytics-enabled authentic assessment design approach for digital education
T Lim, **S Gottipati**, M Cheong, JW Ng, C Pang
Education and Information Technologies, 1-24, 2023

5. ExGen: Ready-To-Use Exercise Generation in Introductory Programming Courses (**Best technical design paper**)
Don Ta, Phuc Nguyen, and **Swapna Gottipati**
31st International Conference on Computers in Education. ICCE, 2023

6. "Investigating Bloom's cognitive skills in foundation and advanced programming courses from students' discussions"
JJW LIM, **GOTTIPATI Swapna**, KJ SHIM, 30th International Conference on Computers in Education. ICCE, 2022.

7. "Authentic assessments for digital education in the higher education landscape: Emerging technologies shaping assessment practices"
LIMMS TRISTAN, **GOTTIPATI Swapna**, MLF CHEONG, 30th International Conference on Computers in Education. ICCE, 2022

8. "VR computing lab: An immersive classroom for computing learning. "
PANG, Huan Shan Shawn; SHIM, Kyong Jin; LAU, Yi Meng; and **GOTTIPATI Swapna.** *Proceedings of 2022 IEEE International Conference on Teaching, Assessment, and Learning for Engineering, Hong Kong, China,*.

9. "Gamified online industry learning platform for teaching of foundational computing skills"
YM LAU, RJB BARRIOS, **GOTTIPATI Swapna**, KJ SHIM, IEEE International Conference on Teaching, Assessment, and Learning for Education, TALE. 2022.

10. "Profiling Student Learning from Q&A Interactions in Online Discussion Forums"
DL ONG, KJ SHIM, **Gottipati Swapna**, Proceedings of the International Conference on Computers in Education (ICCE), 2021 (**Best Paper Nominee)**

11. "Mining Informal & Short Student Self-Reflections for Detecting Challenging Topics – A Learning Outcomes Insight Dashboard,"
O. De Lin, **S. Gottipati**, L. S. Ling and V. Shankararaman, *2021 IEEE Frontiers in Education Conference (FIE)*, 2021.

12. "Glassdoor Job Description Analytics – Analyzing Data Science Professional Roles and Skills," *2021.*
S. Gottipati, K. J. Shim and S. Sahoo, *IEEE Global Engineering Education Conference (EDUCON)*, 2021, pp. 1329-1336, doi: 10.1109/EDUCON46332.2021.9453931.

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13. "Rethinking Work Study Programs: A Data Analytics Work Study Program for Undergraduates" (2021).

    Ling, Lo Siaw; **Gottipati, Swapna**; and Shankararaman, Venky. *AMCIS 2021 Proceedings*. 22.

14. "Renewal Of An Information Systems Curriculum To Support Career Based Tracks: A Case Study" (2020).

    Gottipati, Swapna; Shankararaman, Venky; and Shim, Kyong Jin. Proceedings of the 2020 AIS SIGED International Conference on Information Systems Education and Research. 21.