Ph.D. DISSERTATION DEFENSE

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Title:	Scaling NLP Models to Analyze Large-scale Online Conversations
Chairpersons:	Dr. Carlo Lipizzi, School of Systems and Enterprises
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ABSTRACT

In the past decade, Artificial Intelligence (AI) has experienced a notable renaissance. AI's capabilities in parsing complex systems have been particularly evidenced in the advances within Natural Language Processing (NLP). The introduction of the Word2vec algorithm in 2013 offered a means to translate text into numerical vectors and catalyzed the application of convolutional and recurrent neural networks to text analysis. In 2017, Transformers revolutionized the NLP field and started a new chapter in AI with large language models.

Although large language models are highly skilled at answering questions and can access a broad range of knowledge, there remains a need for methods that can visually capture the extent and dynamics of conversations on social media. The applications of AI to complex systems such as large-scale online conversations still present several challenges. Online conversations represent a complex and dynamic fabric of societal discourse with its unique contextual cues and subtleties that are distributed and constantly evolving with no specific boundaries and unpredictable outcomes. Our research has been built around this missions. By marrying the foundational concept of "frames" introduced by Minsky with contemporary AI methodologies, our findings delve into the intricacies of online dialogues, unveiling the deficiencies of current models in capturing the holistic context required for tasks like stance detection. The research aims to develop new tools to analyze online conversations, how they form, the spread and influence of different types of information via these conversations, how the conversations are cross-cutting or coherent, what are the target topics, and how participant opinions toward the target are distributed, and if the extracted knowledge can help NLP models to obtain a better understanding of the context of discussion subjects. The computational tools and data analytics techniques developed in our studies complement the previous research in mining online conversations and provide a useful framework to better understand large-scale conversations. Our developed methods have been used in several studies by other researchers for hate speech detection, disaster risk reduction, and social and political opinion mining paving the way for more advanced and contextually aware AI systems.