

## Accelerating AI and ML Projects with Graph Models

The Core4ce Data Science and Analytics Center of Excellence has focused its resources on the development of a world-class competency in graph technology because we believe graph-based model constructs form the foundation of the more advanced disciplines of artificial intelligence (AI) and machine learning (ML).

Graph models provide a versatile and powerful representation of data, which in turn can facilitate the understanding and analysis of complex relationships and patterns in real-world scenarios.

**Key aspects of graph models and their unique applications in the AI and ML space include:**

**STRUCTURE:** Graph models consist of nodes (vertices) representing entities and edges (links) representing relationships or interactions between entities. This structure allows for a natural representation of complex systems, such as social networks, biological networks, and transportation systems.

At Core4ce, we have successfully employed such models to accurately predict probable chains of transmission for pandemic modeling as well as in biothreat simulation and response initiatives.

**RELATIONAL LEARNING:** Graph models provide a framework for relational learning, where the goal is to learn patterns and make predictions based on the relationships and interactions between entities. Relational learning is a fundamental aspect of many AI and ML applications, such as knowledge graphs, recommender systems, and natural language processing. We have successfully employed graph-based recommender systems to provide correlation inferences between disparate data sets.



**GRAPH NEURAL NETWORKS (GNNs):** GNNs are a class of deep learning models specifically designed to operate on graph-structured data. These models have gained significant attention in recent years due to their ability to learn complex patterns and generalize across different graph structures. GNNs have been successfully applied to various AI and ML tasks, including node classification, link prediction, and graph classification. We have successfully developed graph-based deep learning models to predict internal workforce composition requirements against a set of stated task definitions.

**SCALABILITY:** Graph models can handle large-scale data by leveraging techniques such as sampling, partitioning, and parallelization. This enables our researchers to tackle real-world problems with massive amounts of data, making graph models indispensable for many AI and ML applications.

**INTERDISCIPLINARY APPLICATIONS:** Graph models have been employed across a wide range of disciplines, including computer vision, natural language processing, drug discovery, and social network analysis. The versatility of graph models has enabled our researchers to tackle these sorts of complex problems and develop novel solutions in a variety of fields.

**To learn more** about Core4ce's Data Science and Analytics Center of Excellence and our graph technology capabilities, please contact Chief Scientist Mark Poe at [mark.poe@core4ce.com](mailto:mark.poe@core4ce.com).

## ABOUT CORE4CE

**Core4ce is a mission-oriented company that serves as a trusted partner to the national security community.**

Everything we do is predicated on the belief that data plays a critical role in securing our nation's competitive advantage. We understand the complexity of managing data, the value in wielding it to meet mission needs, and the burden of safeguarding it.

We assemble experienced, interdisciplinary teams that provide lasting value to our defense, intelligence, and commercial customers. We earn the respect of our partners by delivering exemplary customer service and developing technical solutions to solve complex security challenges.

