

TITLE: SIMULATED ENTERPRISES – Capability Management and Digital Twin Simulation Environments to Modernize Enterprise Resource Planning of Human Personnel in Enterprises

CRITICAL TECHNOLOGY AREA(S): Trusted AI and Autonomy, Advanced Computing and Software

OBJECTIVE: Develop an autonomously enabled recommendation based digital twin simulation environment to streamline recruitment, forecast and optimize essential and mission critical human resource functions, modernize existing skill management solutions, and create a single source-of-truth system with data visualization capabilities.

DESCRIPTION:

Identifying and storing personnel management records can be more easily accessed with innovations in graph search approaches demonstrated in other domains such as cybersecurity and logistics. Enterprise resource planning systems are akin and can benefit due to advances in pattern recognition, artificial intelligence, and machine learning. Open sources rapidly become accessible while enriching simulated representations of individuals via their digital profiles. The profile of an individual determined from standard pattern-of-life analysis and algorithmic approaches enable unique opportunities to enfranchise an individual throughout the entire personnel management lifecycle. Aggregation of key computable features enables the identification of profiles with roles that match to mission critical functions. This matchmaking process can be paramount to organizational growth.

Natural language processing techniques identify key words related to roles. Aware individuals often determine which key words to include in their resumes. It is now common for individuals to craft digital profiles in order to participate in profile generation rituals. A byproduct of this cultural emergence is an increase in signals that algorithms trivially parse. A simple example is resume analysis. Databases of parsed and classified profile data can provide a foundation for more advanced enterprise resource planning systems. Industry 4.0 systems include cyber physical systems, internet of things, networks, and smart factories. The abundance of open sources encourage cross-pollination of techniques used in digitized manufacturing whereby human error and variance within Industry 4.0 simulations allow decisive changes to improve efficiency in manufacturing. Similarly, backward planning mission oriented systems with specific computable features can model variance and thereby limit errors in personnel management practices. Probabilistic modeling techniques, including Monte Carlo analysis, can model variance to overcome random chance and other unconstrained Gaussians within the human management sector.

Critical success factors of an organization should be understood when building an enterprise resource planning system. In building a digital twin of the enterprise, simulation in the variance of critical success factors would enable enterprises to rapidly modernize skill management systems. Applying Industry 4.0 paradigms can augment enterprises and can create source-of-truth systems for identifying capabilities of human personnel and the general workforce. An advanced graph based simulation of the pattern-of-life of individuals in the workplace can further enfranchise personnel to produce enriched capabilities for the enterprise.

Dynamic systems make use of Industry 4.0 to forecast demand. In a human resource context, applying simulation analysis and machine learning techniques to the enterprise treats the entire organization like a digital human factory. The digital twin of a personnel management ecosystem allows for better decision analysis and operational support. Capabilities matched with compatibility metrics can in turn

match requirements of the enterprise to its personnel. A model of enterprise throughput can include planning, organizing, staffing, leading, and other organizational control. The enterprise digital twin can also model distributed systems of labor to provide feedback for state-of-the-art machine learning and automation processes. With the further use of closed-loop feedback, the digital twin can model related supply chain funding opportunities. Through targeted funding of vendors that support the enterprise, the enterprise can enable the creation of certain roles that will be in demand and increase the future likelihood of certain matches between candidates and the future roles of the enterprise.

PHASE I: Display automated recommendation techniques to demonstrate feasibility of simulation approaches to modeling enterprise resource planning methods. Apply open sources to develop single source-of-truth modeling of critical success factors of an organization. Demonstrate the viability of creating a digital twin of an enterprise. A set of records corresponding to the human personnel should be available to end-users of the simulated enterprise. The initial results should generate pattern-of-life records simulating the variance between agents in the simulation. Skill management records should also allow end-users to generate executive summaries and reports of the enterprise. The concept should have the potential to be developed into a production-ready prototype with an ability to accept data sources via standard application programming interfaces. The Phase I work will include design specification and supporting technical documentation for developing a prototype to be developed during Phase II

PHASE II: Develop a prototype system to demonstrate and verify the initial concepts in Phase I. Fully develop the sensors to read open sources into the simulated enterprise digital twin. Demonstrate the machine learning based recommendation system for suggesting enhancements to the existing enterprise. Demonstrate executive decision making capabilities and support with complex reporting and data visualization.

PHASE III DUAL USE APPLICATIONS: Transition the prototype to production environments for U.S. Government use. Further develop the simulation and forecasting techniques for further optimization based on general critical success factors of enterprises in commercial sectors.

KEYWORDS: Digital Twin; Simulation; Enterprise Resource Planning; Critical Success Factor; Graph Search; Closed-Loop Feedback; Recommendation System; Artificial Intelligence/Machine Learning; Data Visualization

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