Intelligent Query and Learning System for Logistics

For: MSc or PhD Students; 12 months

Program supported: AI for Logistics

Academic Collaborator	NRC Principal Investigator	Associated NRC Research Centre
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Project Description:

Knowledge fusion is a new approach to integrate knowledge structures to answer questions in smarter and more comprehensive ways. Knowledge structures could be augmented along with different knowledge sources with dynamic knowledge update using learning and reasoning based on qualitative, probabilistic, and deterministic values with associated rules. This project is aiming at the development of novel adaptive knowledge structure with dynamic update based on multiple sources, such as documents, web pages, voices, input texts, images, and videos. Query and learning techniques will allow multiple users to integrate their knowledge packages and train the system with different views to answer questions. The proposed Intelligent Query and Learning System (IQLS) will provide a platform where different users can create and integrate their own knowledge and train the system using multiple knowledge sources. Logistics knowledge management will be supported using the proposed platform, which will support logistic chains and services.

Application of AI paradigms to Logistics requires large and diverse amounts of data. This data originates from new digital contextual data sources (Traffic, accidents, weather etc.), open knowledge initiatives (Canadian open government) or experimental project data (from road, rail-track, and vehicle sensors). AI4Logistics is developing a repository (Canadian Logistics Data Vault) housing collected data and building the tools to manage its variety: search/exploration, visualization etc. The Intelligent Query and Learning System (IQLS) will enable the exploration and retrieval of diverse data holdings collected in the vault regarding logistics and transportation networks. An example of use is for transportation networks' emergency procedures and data (accidents, extreme weather events, CBRN defense (Chemical, biological, radiological and nuclear)) which are developed at different levels of government (Federal, provincial, municipal) and by different organizations, often still coded as lengthy procedural documents. This domain knowledge will be fused in the vault's knowledge base and queried by IQLS.

Student Profile:

The proposed work will be split between two students who will work in parallel to develop basic methods, and interact throughout the internships to evaluate interfaces and applications on the selected use cases.

Education in: Computer science, AI, data science, or related programs.

Essential skills will include: AI, data structures, Python programming, probability theory, statistics, and programming.

Students will learn two types of skills and methods, such as the following:

- Knowledge structure, Ontology, learning, reasoning, and rule-based techniques, Artificial Neural Networks (ANN), deep learning, and Python programming.
- Real time systems, data acquisition, sensors, and risk management for logistics chains and services.

Student #1: Development of knowledge structures and semantic networks representation, including domain rules, ontology, data fusion, and probabilistic methods

Student #2: Learning and reasoning techniques, with human experience, and dynamic (data-based) update of semantic networks and knowledge structures.