EXPLAINABLE AI MODEL FOR PRECISE CROP DISEASE PREDICTION THROUGH KNOWLEDGE REPRESENTATION

Padmaperuma C. D.[1] and De Silva L. N. C.[2]

[1]*LNBTI Japanese IT University, Maharagama, Sri Lanka*
[2]*University of Colombo, School of Computing, Sri Lanka*

[1]*chobodi@edu.lnbti.lk*, [2]*lnc@ucsc.cmb.ac.lk*

ABSTRACT

In agricultural sectors, timely and accurate prediction of crop diseases is critical for ensuring food security and maximizing yield. Particularly, AI-powered disease prediction models have emerged as a critical tool for early detection and mitigation of crop diseases. In recent years, the integration of artificial intelligence (AI) in agriculture has shown remarkable potential for revolutionizing crop management practices. While artificial intelligence (AI) techniques have shown promise in disease prediction, their black-box nature often impedes widespread adoption due to a lack of transparency and interpretability. To address this challenge, this concept paper proposes an explainable AI model for precise crop disease prediction, leveraging knowledge representation techniques. This model aims to enhance transparency and interpretability, enabling farmers and agronomists to understand the reasoning behind the predictions. The model integrates structured knowledge representation methods, such as ontologies or knowledge graphs, to encapsulate domain-specific expertise regarding crop diseases, symptoms, and environmental factors. By encoding this knowledge, the model establishes transparent relationships between various disease attributes, facilitating interpretable reasoning and decision-making. The study provides a comprehensive analysis of various knowledge representation techniques, including Ontologies (such as RDF, OWL, or Protégé), Knowledge Graphs (like Neo4j, property graphs, or RDF-based graph databases), Logic-based Representation (including First-order logic, Description Logics (DL), or rule-based systems), Vector Embeddings (like word embeddings, entity embeddings, or graph embeddings), and Hybrid Approaches (which combine multiple techniques for enhanced representation). It evaluates their suitability, limitations, and underscores their importance in advancing sustainable agriculture and food security. The proposed approach will initially undergo empirical evaluations using datasets on rice crop diseases. This process will showcase the effectiveness and practical applicability of the approach, particularly within the Sri Lankan context. By bridging the gap between AI-driven prediction and domain expertise, the model promises to enhance agricultural sustainability and resilience against crop diseases.

Keywords: Knowledge Representation, Knowledge Graphs, Ontology, XAI (Explainable AI), Crop Disease Prediction