# Integrating Semantics with Symbolic AI: The Path to Interpretable Hybrid AI Systems

##### Keynote Speech

#### Time: Thursday, September 19, 2024 - 09:00 to 10:00

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In May 2001, Tim Berners-Lee, James Hendler, and Ora Lassila envisioned the Semantic Web as a revolutionary framework for making Web content understandable to machines, opening up a new horizon of possibilities [1]. Over the past two decades, the Semantic Web has evolved, overcoming numerous challenges and achieving significant milestones. This talk reviews the historical evolution of the Semantic Web and explores the essential role of symbolic formal systems - logic, knowledge representation, and reasoning - in emulating human-like visual representation and formal reasoning.

The integration of Knowledge Graphs (KGs) as central data structures has enabled the fusion of heterogeneous data, facilitating robust knowledge representation and formal reasoning. Despite these advances, purely symbolic approaches have limitations, particularly when dealing with the complexity and ambiguity inherent in real-world data.

We explore the transformative impact of combining symbolic semantics with inductive learning techniques, and show how this hybrid approach improves the performance of machine learning models over KGs, resulting in more interpretable AI systems. By analyzing key case studies in lung and breast cancer, we illustrate how this synergy leads to improved model accuracy and transparency, fostering trust and reliability in AI systems.

This presentation aims to highlight the need to fuse semantics with machine learning to develop sophisticated, interpretable AI systems. It will provide insights into the future direction of semantic AI, emphasizing the critical role of semantics in achieving truly intelligent and understandable AI.

Berners-Lee, T., Hendler, J., & Lassila, O. (2001). The Semantic Web. Scientific American.

## Keynote Speaker

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| Maria-Esther VidalTIB-Leibniz Information Centre for Science and Technology. Leibniz University of Hannover and L3S Research Centre | Prof. Dr. Maria-Esther Vidal is Full Professor at the Leibniz University of Hannover and Head of the TIB Research Department. She is also a member of the L3S Research Center and Full Professor (retired) at the Universidad Simón Bolívar (USB), Venezuela. Her research focuses on data management, semantic data integration, and machine learning over knowledge graphs, areas crucial for modern information systems. Maria-Esther has co-authored more than 240 peer-reviewed articles in the areas of Semantic Web, Databases, and Artificial Intelligence. She was awarded the Science Prize for Responsible Research by the Stifterverband, recommended by the Leibniz Association, and supported by the "Leibniz Best Minds: Program for Women Professors" supported by the Leibniz Association, Germany. Maria-Esther is also active in her research communities. She has served on the editorial boards of international journals and as general chair, co-chair, and senior reviewer of major scientific events (e.g., ESWC, WWW, ISWC, and ECAI). Under her leadership, her team has developed technologies of dominant relevance in the whole process of knowledge graph creation from heterogeneous data and query processing. She serves as an expert in several advisory boards, summer schools, and Ph.D. consortia. She has advised more than 28 Ph.D. students and more than 120 M.S. and B.S. students in computer science. |