# *Synergy of Artificial Intelligence and Boolean Search in Patent Prior Art Assessment*

*Marvin J. Slepian*

University of Arizona James E. Rogers College of Law

*Asiful M. Islam, Robert Vacarneau, Jordan E. Rodriguez, Mihai Surdeanu (University of Arizona Department of Computer Sciences)**

Intellectual property plays a crucial role in driving technological and economic advancement in the United States and worldwide. A key factor in translating scientific and technical breakthroughs into valid, useful, and patentable inventions is ensuring that a patent application's written description demonstrates novelty and non-obviousness. A critical step in this process involves comparing the new submission to existing technical work—known as "prior art"—found in both issued and published patents globally, as well as in academic literature. This necessitates the use of *effective* and *explainable* search tools. With the rapid increase in patent applications, artificial intelligence (AI) has emerged as a powerful tool to assist, streamline, and accelerate this process. However, AI search—especially that based on neural networks—is unexplainable due to the "black box" nature of its underlying models. This opacity conflicts with legal requirements to justify why prior art was identified. In contrast, older search algorithms based on Boolean methods are inherently explainable, as they rely on direct query-to-document matching ("what you see is what you get"). Here, we compare and contrast the efficacy and explainability of AI search versus traditional Boolean search. Specifically, we explore two research questions: (a) Can Boolean methods explain the results of AI search? and (b) Can Boolean search fully replace AI search? To address the first question, we develop a method that generates Boolean queries that approximate the outputs of AI search using a set of linguistic heuristics. For the second, we adapt these heuristics to construct Boolean queries based solely on the patent of interest and compare their outputs against AI search. Our experiments on a large patent database indicate that while Boolean methods can explain a majority of AI search results, they cannot fully replace AI search. This suggests that a hybrid approach—where AI retrieves prior art and Boolean methods provide explainability—may represent the future of patent search.

* Corresponding author