Knowledge Extraction and Integration for assessing judicial principles

Research Project

Artificial Intelligence (AI) and Deep Learning (DL) have produced stunning results in a wide variety of domains, setting a new standard in many tasks, such as computer vision, chemistry, game theory, text translation, robotics, and speech recognition, to name a few.
The legal domain has also been affected by this breakthrough, where in several applications, such as legal judgment prediction, argumentative analysis, case law understanding, and document analysis, adopting and evaluating deep learning architectures is a standardized approach. Despite the welcome leap in performance, however, a typical criticism of several DL solutions is their lack of interpretability and inability to learn domain-specific rules when there is no abundance of data. These requirements, such as the interpretability of adopted models, are paramount in the legal domain since AI systems are developed to aid human experts in tasks where their actions may have critical consequences. Thus, AI systems for the legal domain should operate in scenarios where context understanding and transparency are functional requirements for developing trustworthy solutions for human experts.

The primary objective of this research activity is to develop a transparent AI system that (i) processes legal documents (e.g., tax audit acts) to extract judicial principles of law; (ii) integrates domain-specific contextual knowledge, such as EU legal principles traceable back to the processed documents; (iii) produce a human-comprehensible explanation on the extraction process that is grounded on the integrated knowledge.
These capabilities allow legal experts to explicitly assess the efficiency and inference process of the developed system.
This is in line with one of the primary objectives of the POLINE European project funded under the JUST-2022-EJUSTICE Call ("Principles Of Law In National and European VAT"): increase European taxpayers' awareness of the correct application of VAT law and their support in deciding whether it is making an appeal or claiming a violation of European law.
The team of AI and legal experts in the context of POLINE will conduct such an evaluation in the project.

Work Plan

Our methodology comprises two distinct phases: (i) the development of an interpretable model trained in a supervised fashion to extract text snippets from processed documents that are relevant to judicial principles of law; (ii) the adoption of a knowledge integration paradigm to relate extracted content and refine the extraction process by leveraging contextual knowledge.
We define phase (i) as the knowledge extraction phase and phase (ii) as the knowledge integration phase.
The first period of the project will be dedicated to the knowledge extraction phase, with a particular focus on the development of an efficient classification model from both performance and interpretability perspectives. The research will focus on state-of-the-art

solutions in the legal domain to identify the most suitable DL architecture for each task of interest.
Moreover, human evaluation via legal experts' feedback is required to systematically assess the interpretability level of the developed model.
The last period of the project will be dedicated to the knowledge integration phase.
Active collaboration with legal experts will be crucial for identifying and assessing relevant knowledge and refining the developed classification model.

All activities are to be carried out at the University of Bologna’s Department of Computer Science and Engineering (DISI) and in collaboration with the other POLINE partners.