



Neural Natural Language Processing in Legal and Health Care Domains

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What is NLP?

Natural language processing (NLP) refers to the branch of computer science—and more specifically, the branch of artificial intelligence or AI—concerned with giving computers the ability to understand text and spoken words in much the same way human beings can.

Report Attribute	Details
Estimated Base Year Value (2021)	US\$ 11 Billion
Expected Market Value (2022)	US\$ 14 Billion
Anticipated Forecast Value (2032)	US\$ 45 Billion
Projected Growth Rate (2022-2032)	23% CAGR

<https://www.futuremarketinsights.com/reports/natural-language-processing-nlp-market>



Why **N**NLP?

- 1948 – rule-based / symbolic models
- 1990 – statistical revolution / statistical models
- 2013 – neural revolution
 - 2013 – word embeddings
 - 2013 – neural networks for NLP
 - 2014 – sequence-to-sequences
 - 2015 – attention
 - 2018 – pre-trained neural models (BERT, GPT, etc.)



NNLP in Healthcare and in Legal Domains

NLP simplifies and automates a wide range of processes, especially ones that involve large amounts of unstructured text. With NLP, it is possible better analyze the data to help make the right decisions:

- **Healthcare:** As healthcare systems all over the world move to electronic medical records, they are encountering large amounts of unstructured data. NLP can be used to analyze and gain new insights into health records.
- **Legal:** To prepare for a case, lawyers must often spend hours examining large collections of documents and searching for material relevant to a specific case. NLP technology can automate the process of legal discovery, cutting down on both time and human error by sifting through large volumes of documents.



NNLP in Healthcare and in Legal Domains

AI and NNLP
In Industry



AI and NNLP
In Healthcare and Legal
Domains



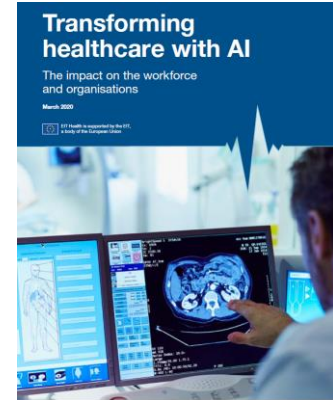
AI and NNLP in Healthcare (1)



The Topol Review (2019)
UK National Health Service (NHS)



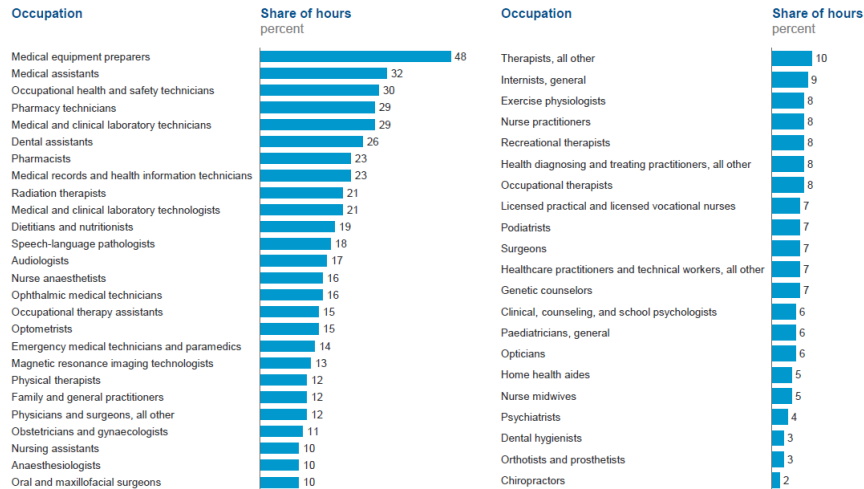
AI and the Health Care Workforce (2019)
American Hospital Association (AHA)



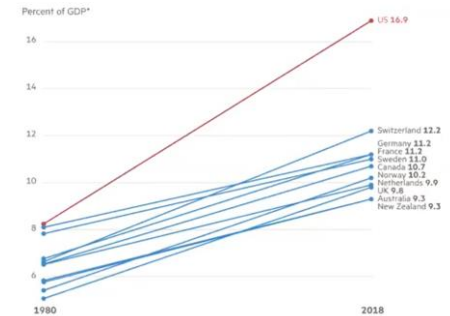
*Transforming Healthcare with AI:
The impact on the healthcare
workforce and organisations
(2020)*
European Union's EIT Health and
McKinsey & Company

AI and NNLP in Healthcare (2)

Exhibit 2 – Share of hours worked that could be freed up by automation by 2030 in selected European countries in the midpoint adoption scenario

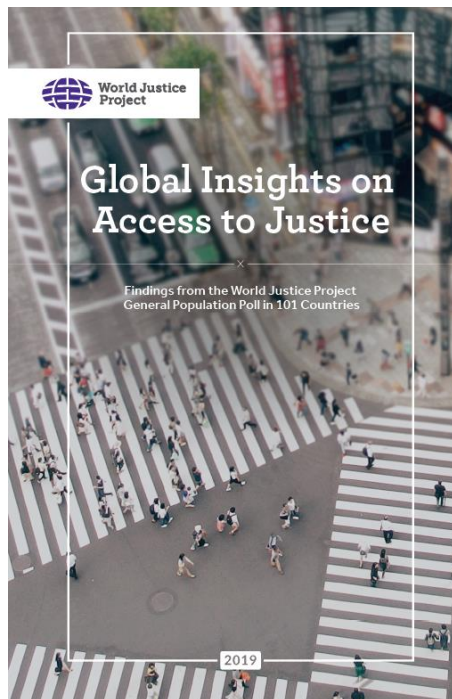


SOURCE: McKinsey Global Institute. Selected European countries: France, Germany, Hungary, Italy, Portugal, Sweden, UK





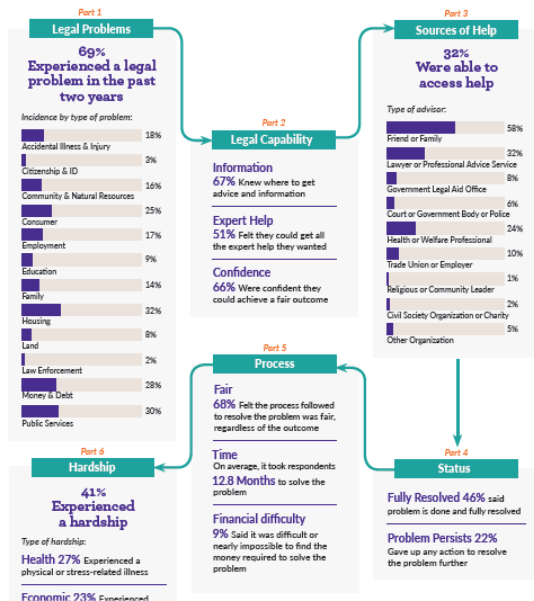
AI and NNLP in Legal domain (1)



AI and NNLP in Legal domain (2)

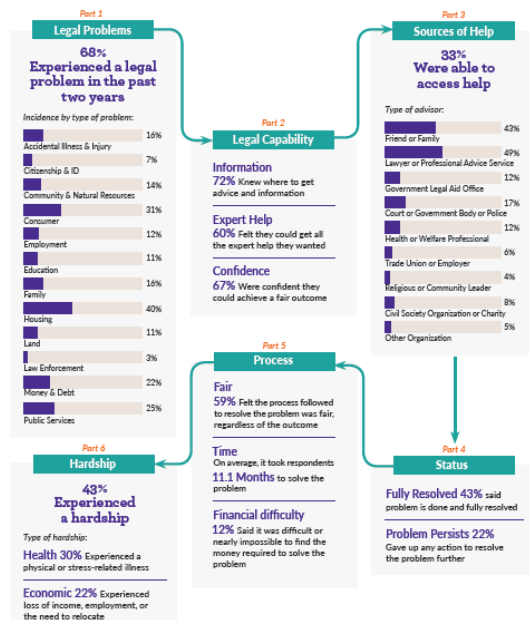
Finland

Paths followed by people in Finland to deal with their everyday justice problems, summarizing the incidence of legal problems, respondents' legal capability, access to sources of help, problem status, assessment of the resolution process, and problem impact.

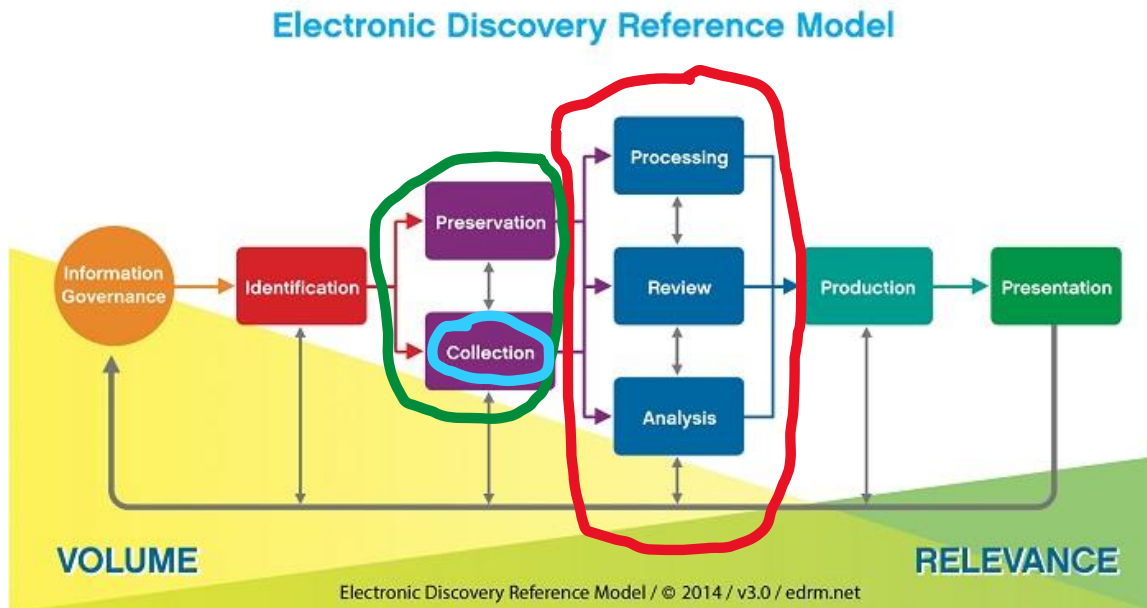


Germany

Paths followed by people in Germany to deal with their everyday justice problems, summarizing the incidence of legal problems, respondents' legal capability, access to sources of help, problem status, assessment of the resolution process, and problem impact.



AI and NNLP in Legal domain (3)





Challenges (1)

According to Susskind, the superficially straightforward question “can technology be leveraged to improve access to justice” conceals at least five questions:

- whether it is *technically possible* for machines to replace law professionals?
- whether even if it were technologically possible it would be *morally acceptable* for machines to take on any judicial functions?
- whether such systems would be *commercially viable*, that is, would their economic benefits outweigh their costs?
- would this be *culturally sustainable*—could such systems be assimilated without rejection into legal institutions dominated by age-old procedures with human judges and other law professionals at their core?
- a legal question: is it *jurisprudentially coherent* to develop such instruments?

Susskind, Richard. *The Future of Law: Facing the Challenges of Information Technologies*. Oxford: Clarendon Press. 1998.



Challenges (2)

The biggest challenges for NLP in Healthcare and Legal domains are similar to those for Natural Language Processing and Understanding generally:

- Language Differences
- Training Data / Lack of Usable Data / Low-resource languages
- Innate Biases
- Understanding clinical/legal language:
 - E.g., unlike Wikipedia or Reuters or Twitter, all sources of major pretrained embedding dictionaries, legal texts are targeted at a specific subset of readers and the most important words in a document are also often the ones with the most specialized meaning



Thank you!

