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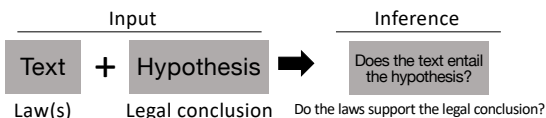
Abstract ➤ We extract claims about COVID-19 related rules in Berlin from newspapers and match them with the constituting laws
 ➤ We achieve promising results with Transformer models, albeit with some conceptual limitations

Motivation

- During the COVID-19 pandemic, new rules were introduced or altered at a rapid pace
- Newspapers informed about them, but **it is hard to find the actual laws that constitute the rules**
- An automated way to match *claims* about COVID-19 related rules with the respective *laws* would aid **fact checking** and **help inform citizens**
- Our idea: Use machine learning

Legal Reasoning and Machine Learning

- Legal reasoning is the process of interpreting legal rules and applying them to facts (MacCormick, 1978)
- In ML often modeled as “**textual entailment**”:



- We use BERT (Devlin et al., 2017) and ELECTRA (Clark et al., 2020)
- Pre-trained weights in German (Chan et al., 2020) that are domain-specific (see Ostendorff et al., 2020)

Challenges with Legal Reasoning

§ 9a SARS-CoV-2-Infektionsschutzverordnung (13.11.20)

(1) The **isolation pursuant to § 8 (1)** shall end at the earliest on the fifth day after entry if a person has a negative test result with regard to infection with the SARS-CoV-2 coronavirus.

Claim

Anyone entering from a **risk area** is in **isolation** for at least five days.

Problems:

- How to resolve such **references**? Not possible in one inference step
- Put „all“ necessary text in input? Not possible due to 512 token limit
- There are similar cases as references, e.g. legal terms and definitions, applicability, changing rules

§ 8 SARS-CoV-2-Infektionsschutzverordnung (13.11.20)

(1) Persons who enter the Land of Berlin by land, sea or air from abroad and who have stayed in a **risk area** as defined in paragraph 4 at any time within 14 days prior to entry are obliged to go directly to their own home or other suitable accommodation immediately after entry and to **seclude themselves there permanently** for a period of 14 days after entry.

Claim Extraction (Definition)

- The claim extraction task is concerned with detecting **claims about legal rules** in a document.
- A claim as defined in this work is **any statement whose veracity can be determined with help of COVID-19 related legislation**. This means the statement must include a legal consequence, meaning an imperative or a prohibition that is imposed by the law.
- Modeled as **token classification**
- Limitation: We only consider **local context**, i.e. relevant information that is located right next to the claim

Claim Extraction (Data Set)

- 48 annotated news paper articles
- **79 samples with a total of 451 claims**
- Sources included berlin.de, rbb24.de (7 articles each), morgenpost.de (6 articles) and tagesspiegel.de (4 articles) and 15 more

Code & Data sets: <https://github.com/DFKI-NLP/covid19-law-matching>

Claim Extraction (Results)

Model	F1	Precision	Recall
gbert-base	0.398 (± 0.051)	0.333 (± 0.048)	0.496 (± 0.069)
gbert-large	0.429 (± 0.057)	0.354 (± 0.052)	0.547 (± 0.067)
gelectra-base	0.418 (± 0.036)	0.357 (± 0.034)	0.507 (± 0.059)
gelectra-large	0.467 (± 0.064)	0.417 (± 0.073)	0.535 (± 0.052)

- 5-fold validation
- Batch size 30, learning rate 2-5, weight decay of 0.01
- Manual inspection is promising

Law Matching (Definition)

- Given a **claim** and a **subsection** from a law, does the subsection match the claim?
- Given a set of subsections S that apply to a claim c, any subsection s ∈ S matches c.

Claim

Sport in covered sports facilities is allowed if it is essential. This includes equestrian sports within the scope of animal welfare considerations.

Subsection

The practice of sports in covered sports facilities, fitness and dance studio and similar facilities is only permitted insofar as it is necessary

1. for the sport of the group of persons mentioned in paragraph 1,
2. for equestrian sports to the extent that is absolutely necessary from the point of view of animal welfare,
3. for therapeutic treatments as well as uses in accordance with paragraph 1.

Otherwise, it is prohibited.

Law Matching (Data Set)

- 858 samples (a sample is a subsection/claim pair)
- Balanced: 50% positive (matching) pairs, 50% negative (non-matching) pairs
- Positive samples are annotated
- Negative samples are constructed randomly
- Skewed towards the period of March to June 2021 (57% of all samples)

Law Matching (Results)

Model	F1	Precision	Recall
TF-IDF baseline	0.741 (± 0.094)	0.944 (± 0.016)	0.619 (± 0.139)
gbert-base	0.880 (± 0.060)	0.871 (± 0.091)	0.893 (± 0.047)
gbert-large	0.736 (± 0.417)	0.723 (± 0.420)	0.757 (± 0.424)
gelectra-base	0.857 (± 0.047)	0.883 (± 0.087)	0.836 (± 0.034)
gelectra-large	0.914 (± 0.070)	0.895 (± 0.120)	0.941 (± 0.024)

- 0.941 (± 0.024), batch size 30, learning rate 2-5, weight decay of 0.01
- Some conceptual limitations:
 - Only laws from the state of Berlin
 - No claims with missing context
 - No claims about changing rules
 - No claims that can only be verified with the fact of a nonexistence of a law

Conclusions

- In general, **legal reasoning is difficult to model** with current ML models
- **Promising results for claim extraction**, but full relevant context remains a challenge
- **Strong results for law matching** (0.91 F1). But strong & simple baseline, and we excluded some difficult cases. Also negative samples are “easy”, since randomly constructed
- **For the limited domain of COVID-19 related rules and conceptual limitations, our proposed design works well**