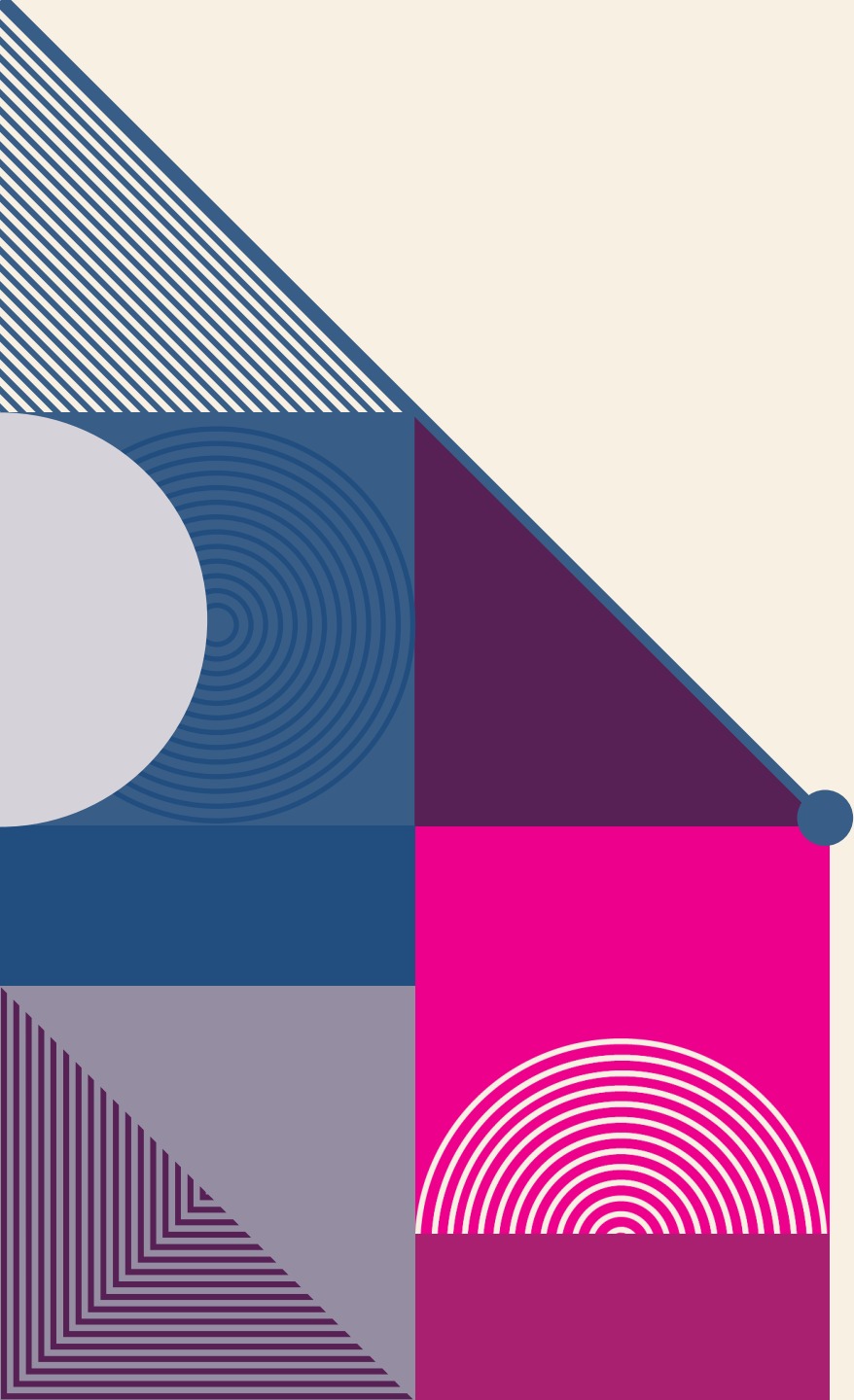# LAW AND AI

ACKNOWLEDGEMENTS

- Thanks to Owl from the Laion server for introducing me to this topic

AGENDA

Introduction/Why Law is Hard

Logical Framework for Law

Can we speed it up?

Data Issues

Current LLM solutions

WHY IS LAW HARD?

3 FUNDAMENTAL ISSUES

COURT STRUCTURE

Approach 1:
Why can't we replace
Judges with computers?

Judges

Prosecution

Lawyers

CAN'T WE JUST "PROVE" GUILT?

- We have

1. Evidence

2. Arguments for why the defendant is Guilty

3. Arguments for why the defendant is innocent

-> Compute?

BIT MORE FORMALLY

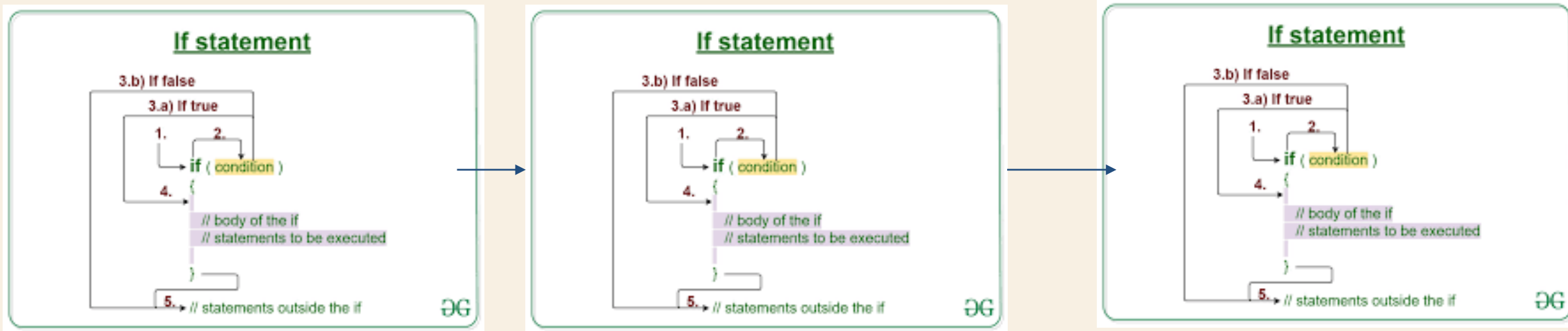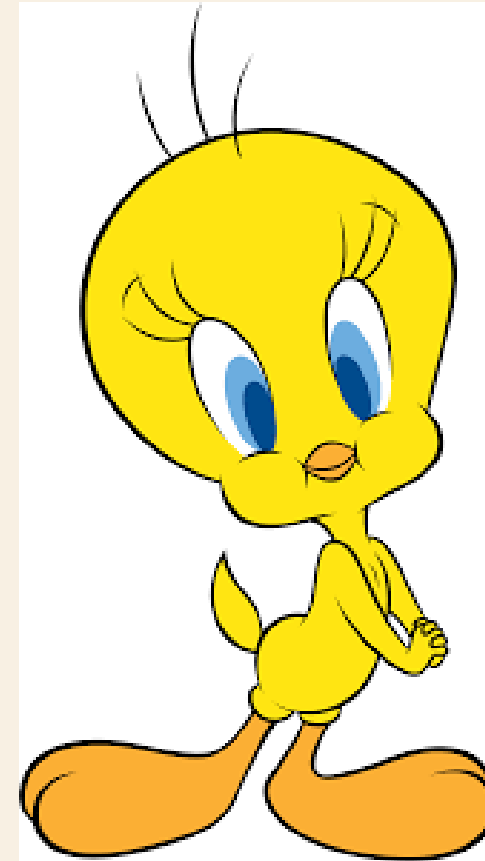- Can't we have a series of If statements to conclude Guilt?

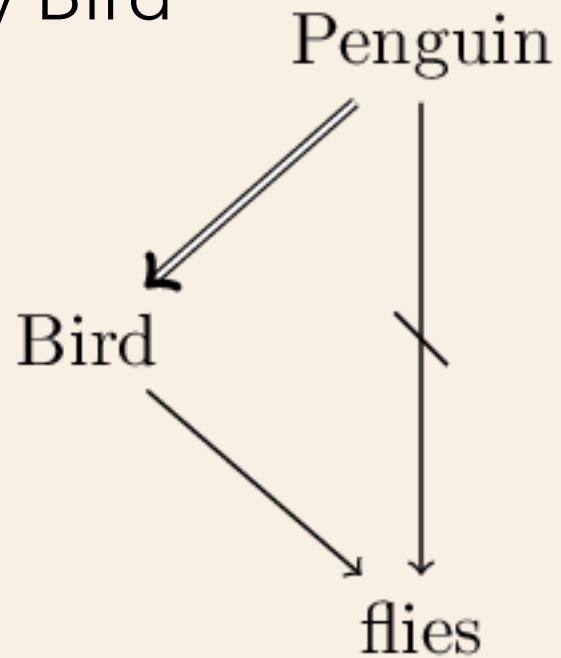Image from https://www.geeksforgeeks.org/java-if-statement-with-examples/

YES BUT... THIS IS NOT TYPICAL LOGIC

- Tweety Bird

Penguin

Bird

flies

Images from https://en.wikipedia.org/wiki/Tweety and https://plato.stanford.edu/entries/logic-nonmonotonic/

NONMONOTONIC LOGIC
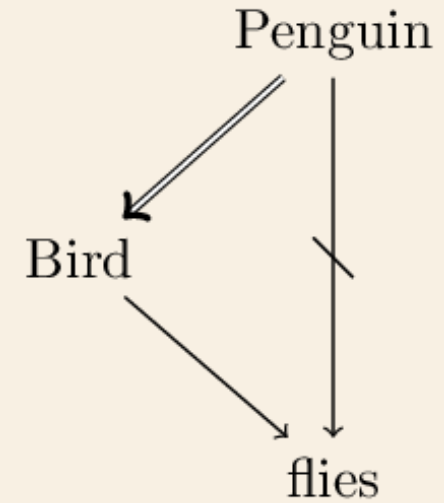
- New facts/arguments can completely change the conclusion
- In our series of If statements one argument can cause us to recompute from start!!

REAL-LIFE EXAMPLE: MAPP V OHIO

Historically, very important US case that made illegal police searches without warrants illegal

Image from https://www.storyjumper.com/book/read/92718926/Mapp-v-Ohio

Fourth Amendment

The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no Warrants shall issue, but upon probable cause, supported by Oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized.

From https://constitution.congress.gov/constitution/amendment-4/

Fourth Amendment

The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no Warrants shall issue, but upon probable cause, supported by Oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized.

Why? On the state level more than ½ of the states were against excluding evidence gotten without warrant

From https://stus.com/Wolf-v-Colorado-cartoon-cpr0036

Fourth Amendment

The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no Warrants shall issue, but upon probable cause, supported by Oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized.

MAPP V. OHIO
1961

Dollree Mapp in May 1957.

Why? More than 2/3 of the states support exclusion rule now!

From https://stus.com/Wolf-v-Colorado-cartoon-cpr0036

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SOME POINTS

1. Laws can change between arguments so the "premise" can be different between each case

2. Judges can reach different conclusions on the same case

Here, I'd like to point out the first fundamental issue with law and AI

THE FIRST FUNDAMENTAL REASON WHY LAW IS HARD(THANKS SINGH)

- Law is perhaps purposely ambiguous and open to interpretation

- Coding law into programs will bring intrepertations per each law and will need to constantly be revised!(Like in Mapp V Ohio)

- So, while people can have an idea of what the coded law is currently, they will have no idea after each case and each new legislation

OPEN INITIATIVES

Catala

```
#### (2) Gross profit percentage

##### (A) In general

The term "gross profit percentage" means the percent which—

(i) the excess of the aggregate sales price of property sold by the employer
to customers over the aggregate cost of such property to the employer, is of

(ii) the aggregate sale price of such property.

```catala
scope QualifiedEmployeeDiscount under condition is_property:
  assertion customer_price ≥ aggregate_cost

  definition gross_profit_percentage equals
    (customer_price - aggregate_cost) / customer_price
```
```

WHAT IS THE MODERN STATE OF RESOLVING ARGUMENTS?

FIRST PAPER THAT INTRODUCED RESOLVING ARGUMENTS

On the acceptability of arguments and its fundamental role in nonmonotonic reasoning, logic programming and n-person games ☆

Phan Minh Dung ✉

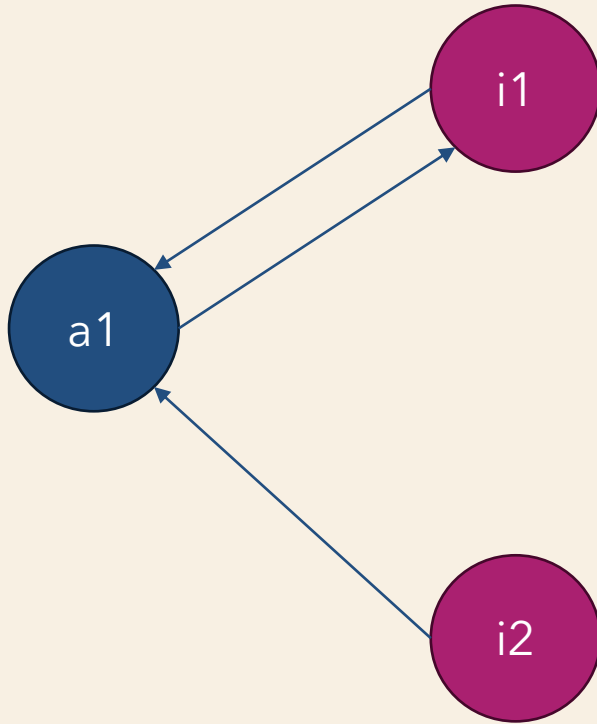Begins with Question: How can we "accept" arguments?

FOUNDATION-BASIC ARGUMENT

- I: "I cannot negotiate with A because they don't even recognize I"=i1

- A: "I doesn't recognize A either"=a1

- I: "But A is a terrorist organization"=i2

Who won this argument?

WITH CIRCLES AND ARROWS

1. i1 and a1 attack each other
2. i2 attacks a1
3. i2 defends i1
The one with the last word wins

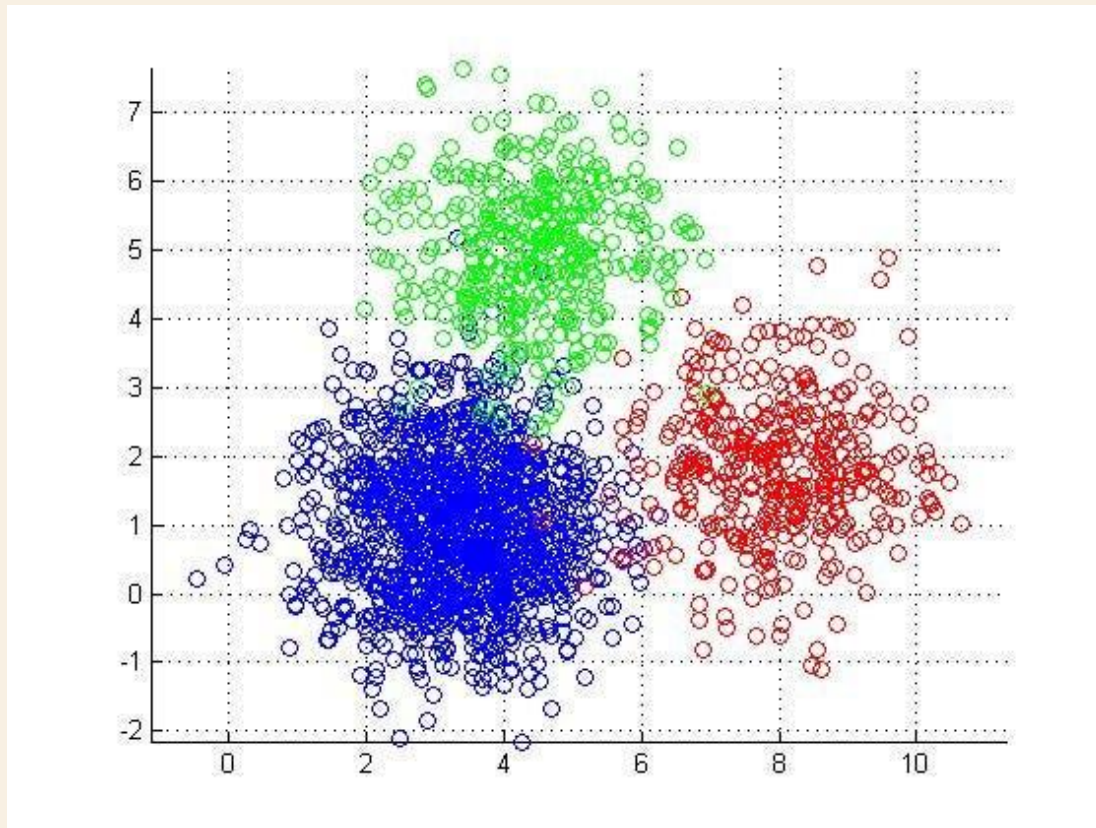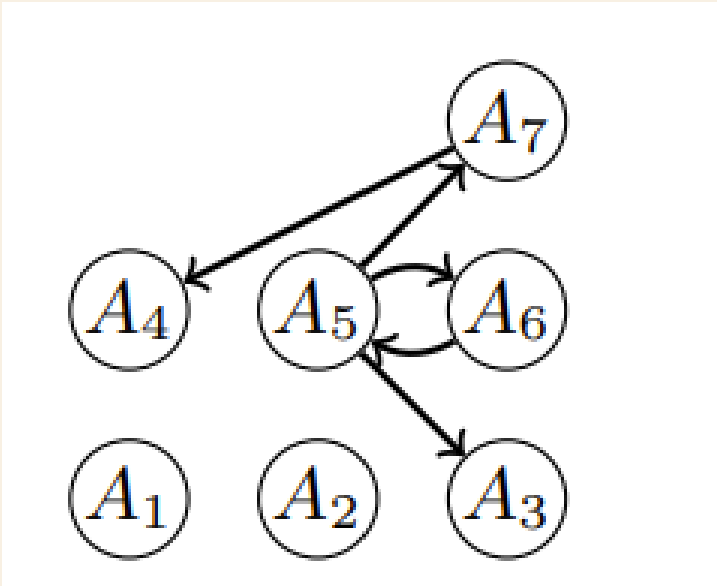# IN THIS WORLD WHAT ARGUMENT IS ACCEPTABLE?

Main argument

Counter arguments

An Argument is accepted if it can defend against all counter arguments = it can attack all counter arguments.

CAN WE CLUSTER ARGUMENTS?

From https://www.kdnuggets.com/2019/09/hierarchical-clustering.html

YES! FOR EXAMPLE

We can get clusters
Always true = (A1, A2)
One argument = (A1, A2, A5, A4)
Other side=(A1,A2, A3, A6, A7)
This is called Complete Extension
Every argument that is acceptable in
The set belongs to the set

From https://proceedings.kr.org/2020/63/

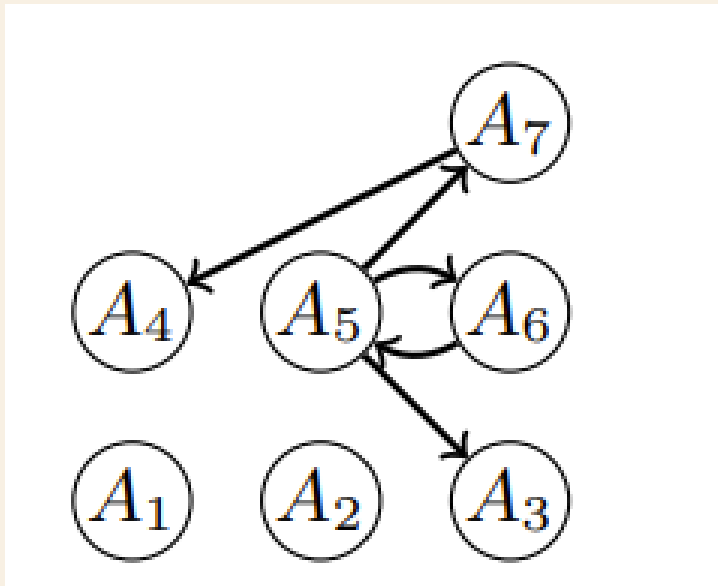# THE SECOND FUNDAMENTAL REASON WHY LAW IS HARD(THANKS SINGH)

- In above, we get clusters with their conclusions but how do we say which is right?

- The only method is for us to form a new argument to attack some clusters until there is only one cluster with one "conclusion"

- So, overall, even in the best-case scenario, we still need judges

NOW, WHAT'S THE COMPUTATIONAL COMPLEXITY?

An Answer Set Programming Approach to Argumentative Reasoning in the ASPIC+ Framework

Tuomo Lehtonen (University of Helsinki)
Johannes P. Wallner (Vienna University of Technology)
Matti Järvisalo (University of Helsinki)

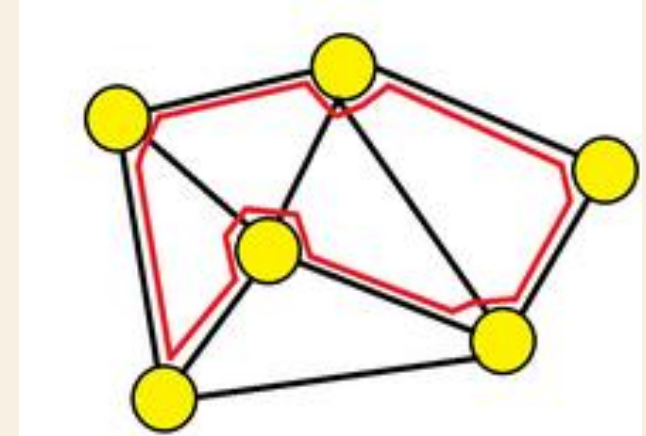# WE CAN MAP OUR ARGUMENT FRAMEWORK TO ANSWER SET PROGRAMMING!

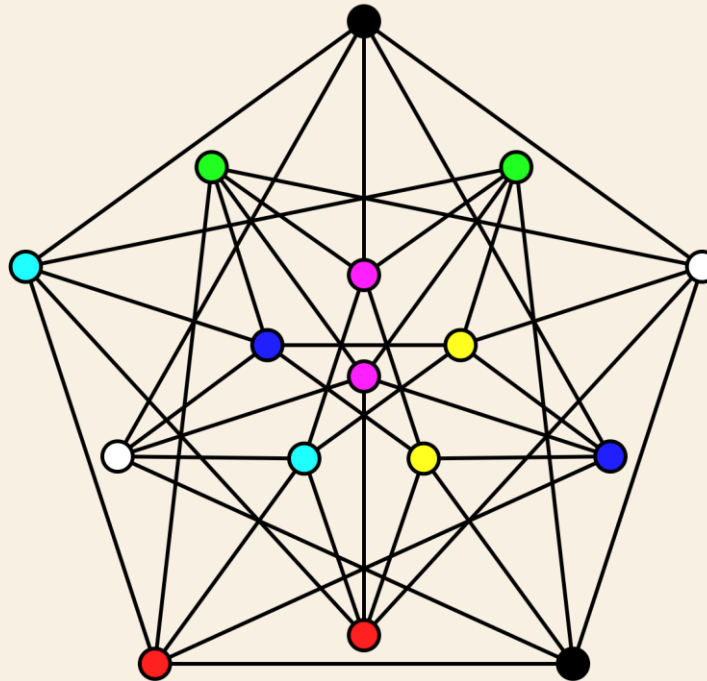

Which means we can make a program out of it!

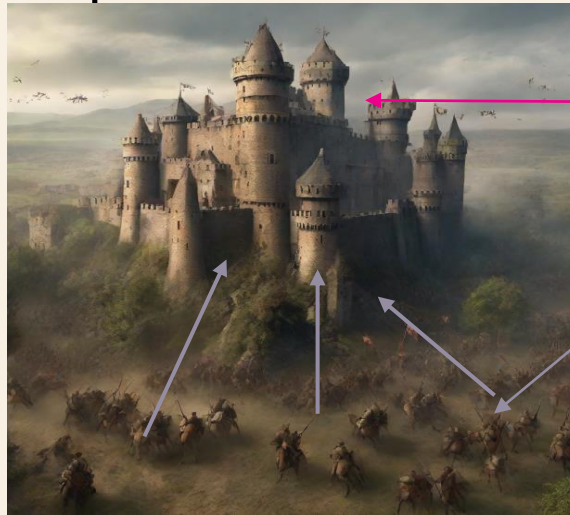# OTHER ASP PROBLEMS

- Graph Coloring
- Hamiltonian Cycle

These are very hard computer science programs in set of problems that are NP-Complete.
How about arguments?

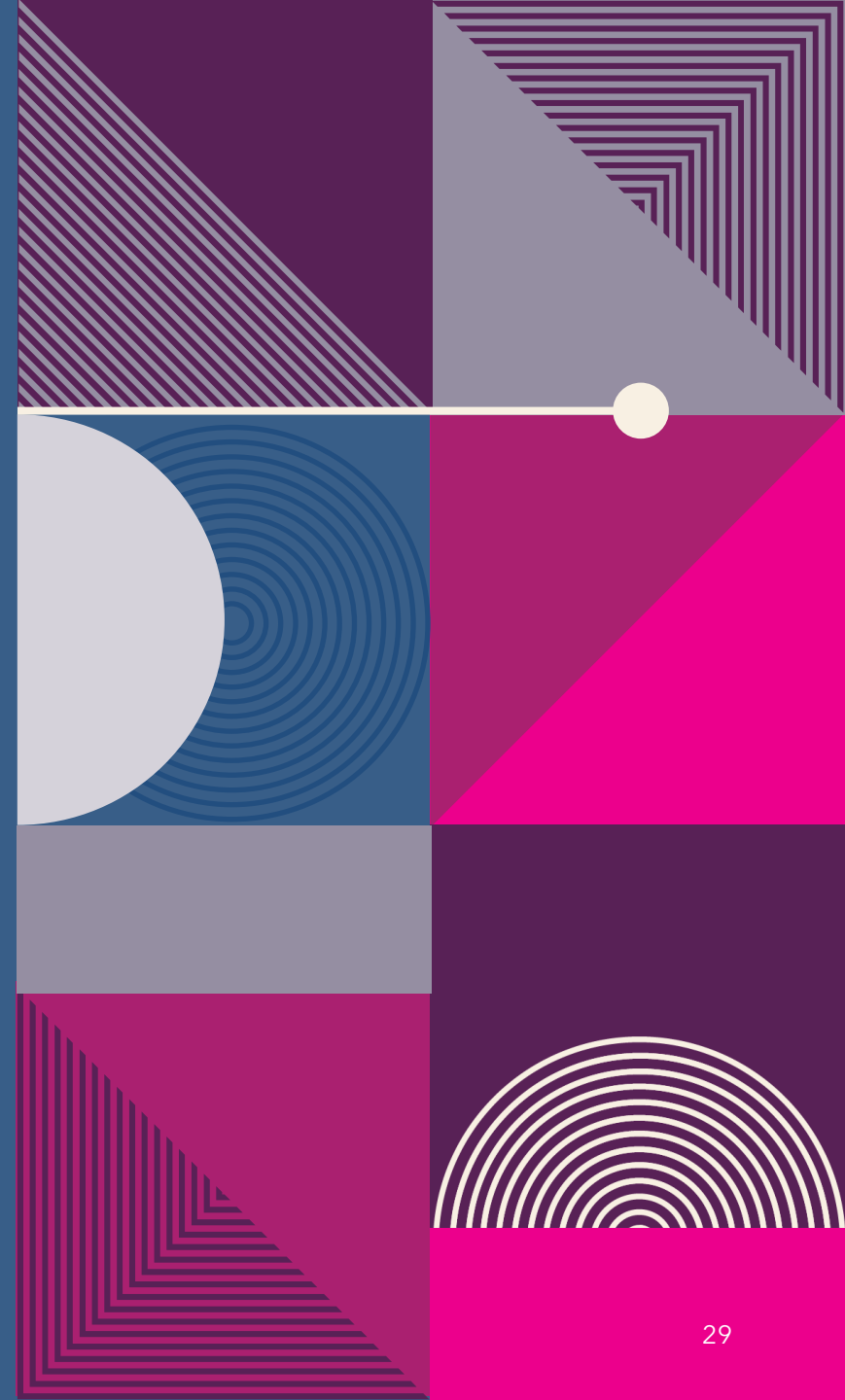# THE THIRD FUNDAMENTAL REASON WHY LAW IS HARD

- Also, NP Complete

- Every new argument can completely destroy previous arguments.

- We might need to recompute from scratch every time!
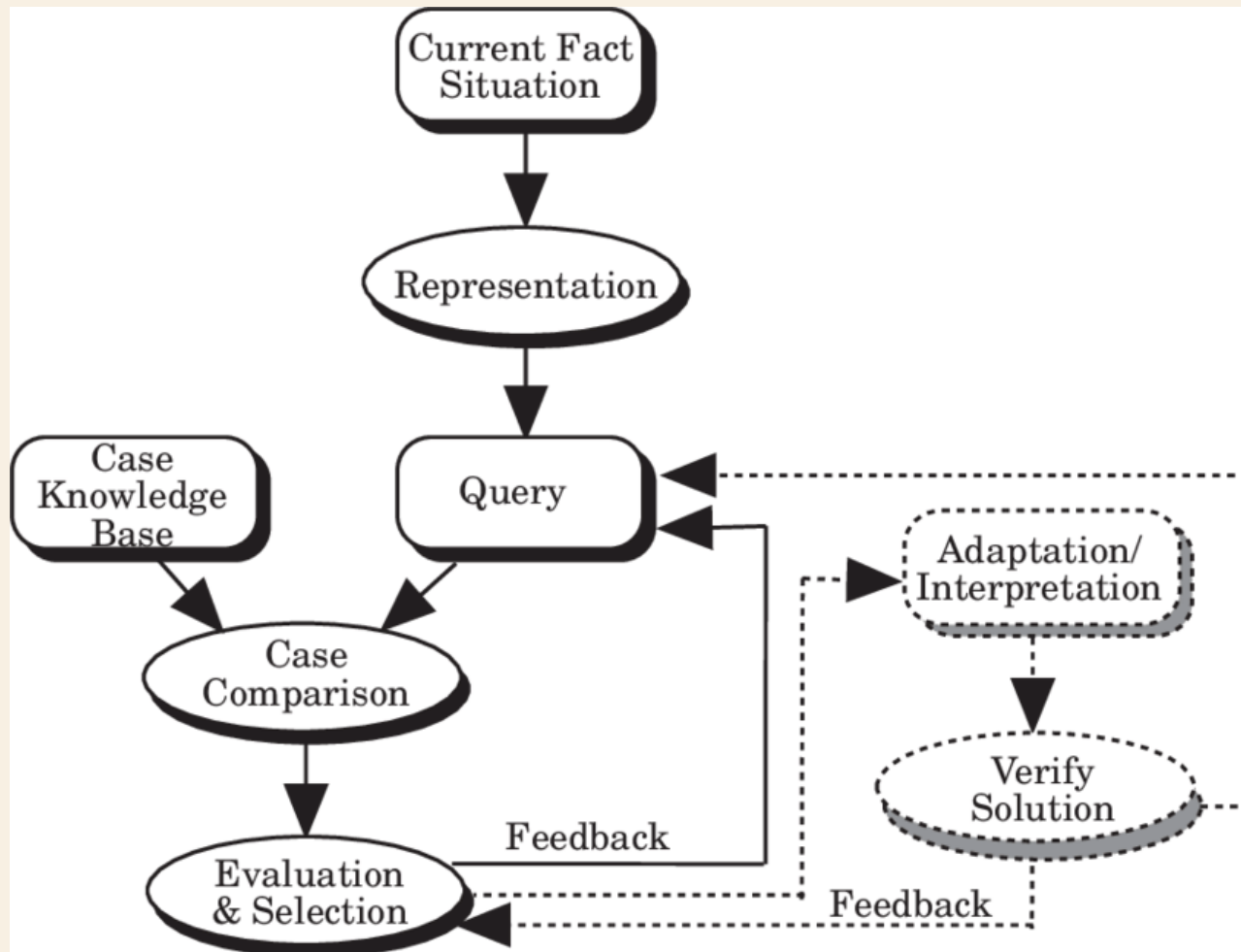

Main argument

Counter arguments

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CAN WE SPEED THIS UP?

HYPO-THE "FIRST" LAW AI IN 1987

Issues:
1. Representation may not be correct
2. Assumes past case results are always true
-> Mainly just for trade secrets

CAN WE ADD SOME ARGUMENTS WITHOUT MAKING IT EXPONENTIAL?

- "Induction of Defeasible Logic Theories in the Legal Domain"

- Given evidence, choose "greedily" best arguments to get to conclusion(given a dataset)

- There is a trade off between **how true our conclusion** is and **performance**

- **Human judges do not get the "true" answer but an approximation over "main" arguments. Ex, precendences**

DATA ISSUES

PACER-CAN BE A US ISSUE

Cost for Accessing PACER

$0.10 per page:

THE DIFFERENT TYPES OF PAGES

Document, such as a docket, motion, order, judgement or brief in a case. You won't be charged more than $3 per document.

PACER Search Results – Anytime a search is performed you are charged a fee based on the number of pages generated in the search, even if the search displays "no matches found." There is no maximum fee for these searches.

Reports that are not case-specific, such as the cases report. There is no maximum fee for these reports.

Transcript of court proceedings are added to PACER 90 days after they are produced. There is no maximum fee for transcripts in PACER. Learn more.

$2.40 per audio file:

Audio Files are provided as .mp3 files for some hearings as part of the court record.

COURT LISTENER-NON PROFIT

Document Number	Date Filed	Description	
19	Jul 23, 2013	REPORT AND RECOMMENDATIONS re Petition for Writ of Habeas Corpus: The Magistrate Judge RECOMMENDS that the petition for a writ of habeas corpus be DISMISSED and that the pending motion to reconsider the order denying petitioner's motion for appointment of counsel be denied. His more recent 17 motion to appoint counsel is denied as well. Objections to R&R due within fourteen (14) days of the date of this Report. Signed by Magistrate Judge Terence P Kemp on 7/23/2013. (er1) Main Document	Download PDF ▼
24	Aug 20, 2013	OPINION AND ORDER adopting and affirming the Magistrate Judge's 07/23/13 Report and Recommendation recommending that the instant petition for a writ of habeas corpus be dismissed. The Petitioner's objections to the Magistrate Judge's Report and Recommendation 22 are overruled. Petitioner's Motion for Summary Judgment 18 is denied. This action is DISMISSED. Signed by Judge Edmund A Sargus on 08/20/2013. (dh1) Main Document	Download PDF ▼
25	Aug 20, 2013	JUDGMENT is entered pursuant to the Opinion and Order filed 08/20/2013. This case is closed. (dh1) Main Document	Download PDF ▼
29	Apr 12, 2017	Main Document Docket Annotation	Buy on PACER

Data in legal domain, most likely has the main document/arguments is behind paywalls

LARGEST OPEN SOURCE LAW DATASET

Cornell University

arXiv > cs > arXiv:2207.00220

Search...

Help

Computer Science > Computation and Language

Pile of Law: Learning Responsible Data Filtering from the Law and a 256GB Open-Source Legal Dataset

Peter Henderson, Mark S. Krass, Lucia Zheng, Neel Guha, Christopher D. Manning, Dan Jurafsky, Daniel E. Ho

DATA SOURCES

- Legal Case Opinions and Filings <= Court Listener is the biggest part of the dataset

- Legal analysis

- Laws

- Contracts

- Conversation

- Study Materials

Data Source	Data Size	Word Count	Document Count
Court Listener Opinions	59.29GB/19.76GB	7.65B/2.55B	3.39M/1.12M
Court Listener Docket Entries and Court Filings	52.13GB/17.38GB	5.36B/1.79B	1.49M/496K
U.S. Supreme Docket Entries and Court Filings	1.51GB/0.50GB	151.05M/51.73M	48K/16K
U.S. Board of Veterans' Appeals Decisions	13.21GB/4.40GB	1.74B/580.98M	630K/210K
U.S. Federal Trade Commission Advisory Opinions	1.55MB/0.52MB	157K/53K	112/33
U.S. National Labor Relations Board Decisions	994.83MB/331.61MB	120.33M/39.20M	24K/8K
U.S. Department of Justice Executive Office for Immigration Review *Immigration & Nationality Decisions*	22.89MB/7.63MB	3.05M/1.01M	1671/558

ISSUES

1. Same issue as Court Listener. Very few "main" documents

2. We don't know the current law/precedence at the point of each texts. Current rulings can be wrong now but correct in the past

LOW HANGING FRUIT: ORAL ARGUMENTS

CURRENT LLM APPROACHES

CHINA IS MOVING TOWARDS AUTOMATING JUSTICE

ACADEMIC ARTICLE

The Smart Court – A New Pathway to Justice in China?

Changqing Shi*, Tania Sourdin† and Bin Li‡

"promoted easier access to justice, enabled faster dispute resolution, saved costs by moving the judicial process online and ensured that judgments can be enforced."

LLMS FOR LAW FROM CHINA

1. LawGPT_zh
2. LexiLaw
3. Lawyer LLaMA
4. HanFei
5. ChatLaw
6. Lychee
7. WisdomInterrogatory
8. JurisLMs
9. Fuzi.mingcha

GENERAL APPROACHES: LAWYER LLAMA

TYPICAL COMBO

1. Pretrain

2. Make an instruct/Use an instruct dataset in that domain for Supervised fine-tuning

While it might work not specific to law.

INTERESTING AI: CARPER AI

Court Opinions

Unstructured legal assessments

Pre-trained LLM

Optional: Fine-tune w/ self-supervision on Legal Text

LLM converts data into thousands of **Time Steps** of structured **state-action-reward** data
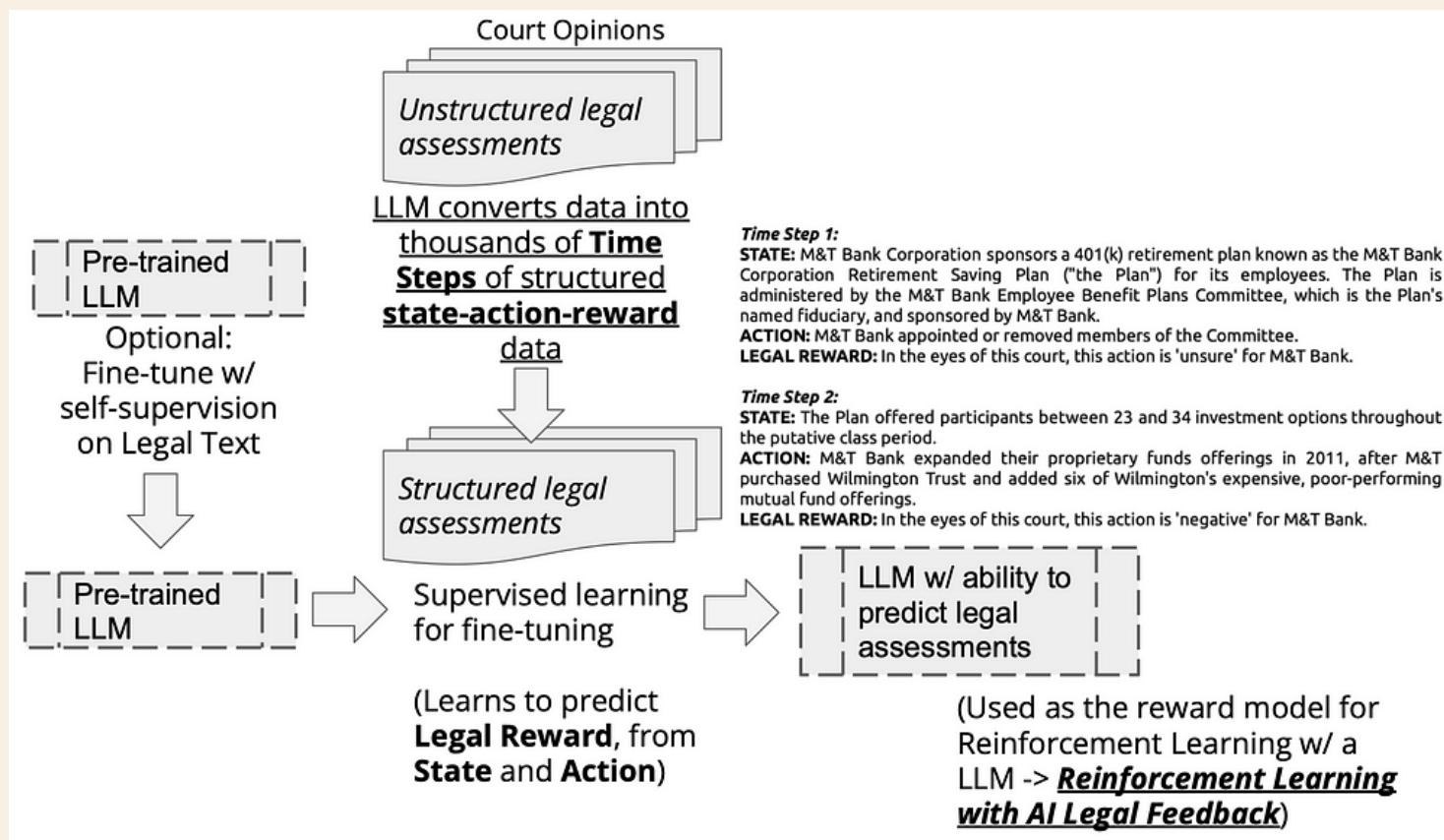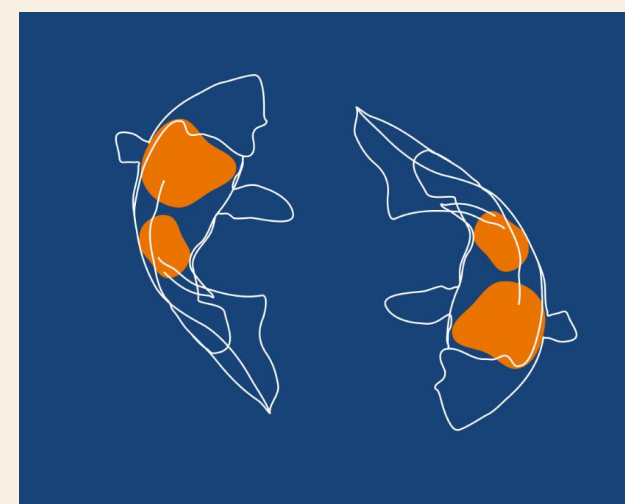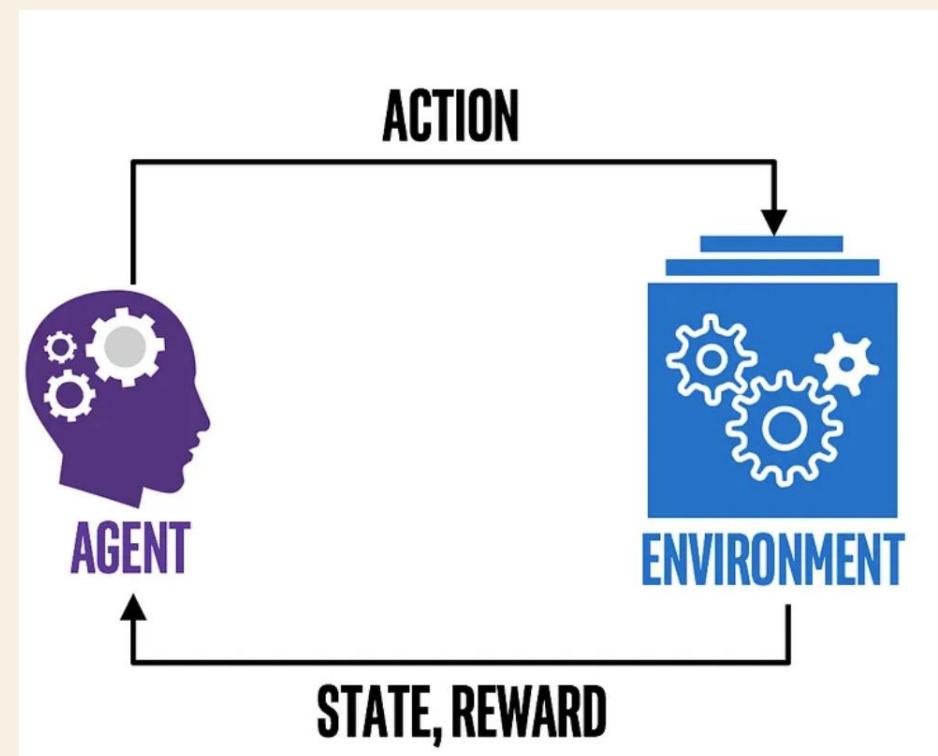
Structured legal assessments

Pre-trained LLM

Supervised learning for fine-tuning

(Learns to predict **Legal Reward**, from **State** and **Action**)

Time Step 1:
STATE: M&T Bank Corporation sponsors a 401(k) retirement plan known as the M&T Bank Corporation Retirement Saving Plan ("the Plan") for its employees. The Plan is administered by the M&T Bank Employee Benefit Plans Committee, which is the Plan's named fiduciary, and sponsored by M&T Bank.
ACTION: M&T Bank appointed or removed members of the Committee.
LEGAL REWARD: In the eyes of this court, this action is 'unsure' for M&T Bank.

Time Step 2:
STATE: The Plan offered participants between 23 and 34 investment options throughout the putative class period.
ACTION: M&T Bank expanded their proprietary funds offerings in 2011, after M&T purchased Wilmington Trust and added six of Wilmington's expensive, poor-performing mutual fund offerings.
LEGAL REWARD: In the eyes of this court, this action is 'negative' for M&T Bank.

LLM w/ ability to predict legal assessments

(Used as the reward model for Reinforcement Learning w/ a LLM -> *Reinforcement Learning with AI Legal Feedback*)

RLAIF: Scaling Reinforcement Learning from Human Feedback with AI Feedback

Harrison Lee, Samrat Phatale, Hassan Mansoor, Thomas Mesnard, Johan Ferret, Kellie Lu, Colton Bishop, Ethan Hall, Victor Carbune, Abhinav Rastogi, Sushant Prakash

1. Have LLM learn to predict how well the current action given "state" is(Judge)

2. Given this state, train the next LLM to find "action" to maximize reward!(Lawyers/Prosecutors)

From https://medium.com/ai%C2%B3-theory-practice-business/reinforcement-learning-part-1-a-brief-introduction-a53a849771cf

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ISSUES

Non-monotonic logic frameworks like ASP not used and also same data issues:

1. Same issue as Court Listener. Very few "main" documents

2. We don't know the current law/precedence at the point of each texts. Current rulings can be wrong now but correct in the past

CONCLUSION

Currently, the main challenges of Law in AI seem to be

1. At least in the US, the prohibitory access to court cases in data

2. The computational complexity of the argument framework for argumentation is NP-Complete

3. Lack of consideration of laws changing with time.

4. Lack of connection between logic frameworks and LLMs

THANK YOU

PAPERS

- On the acceptability of arguments and its fundamental role in nonmonotonic reasoning, logic programming and n-person games

- An Answer Set Programming Approach to Argumentative Reasoning in the ASPIC+ Framework

- Induction of Defeasible Logic Theories in the Legal Domain

- Pile of Law: Learning Responsible Data Filtering from the Law and a 256GB Open-Source Legal Dataset

- The Smart Court - A New Pathway to Justice in China?

- Large Language Models in Law: A Survey