



# Towards Enhanced Accountability in Complying with Healthcare Regulations

Preethu Rose Anish, Vivek Joshi, Abhishek Sainani, Smita Ghaisas  
TCS Research  
Pune, India

# Introduction

- The healthcare ecosystem is highly complex
  - Multiple stakeholders, intersecting interests !
  - Heavily regulated industry !
- Cost of attaining compliance steadily grown over the last few years (43% increase from 2011)
  - Heavily regulated industries (e.g. healthcare), carry large portions of this burden
    - \$19 million as of 2017
- Most impactful healthcare regulation – HIPAA
  - Top 5 most difficult compliance to achieve
  - Violations cause disclosure of sensitive information, economic loss, reputation damage

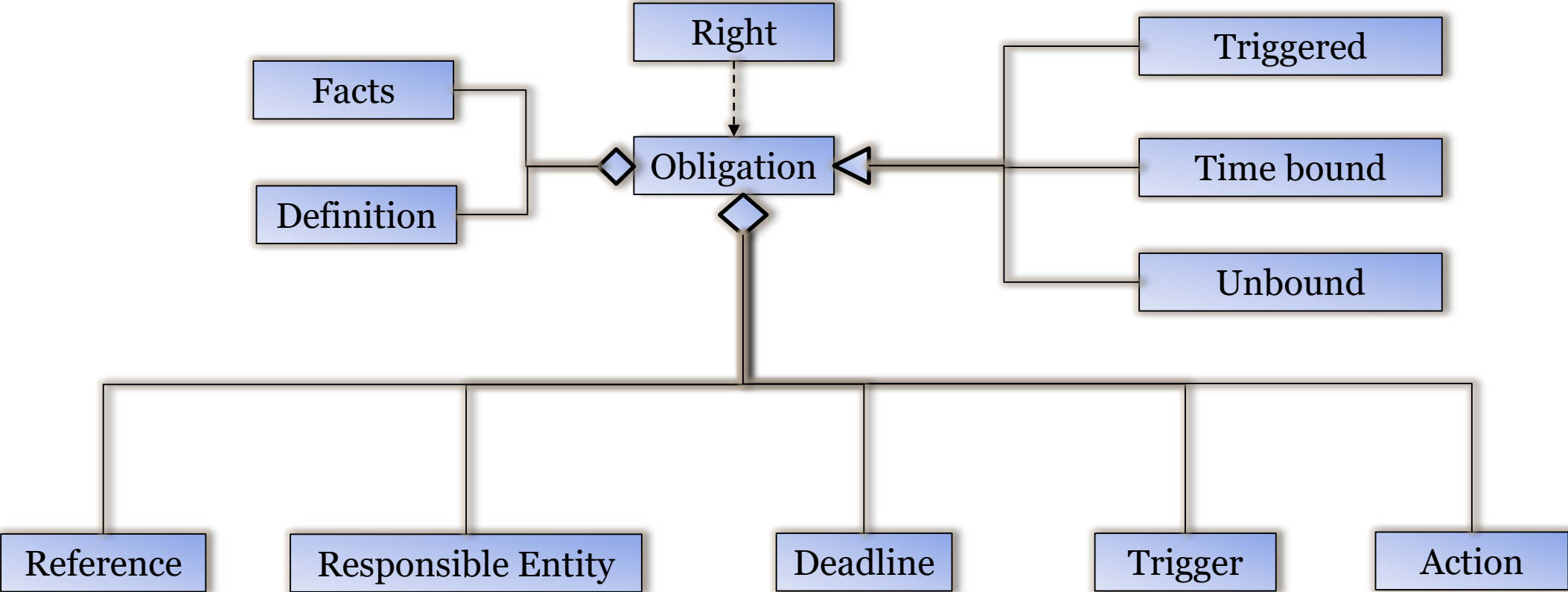
# Decoding Obligations

- Deontic Modalities (Obligations, Rights, Prohibitions )
  - complexity of legal document language
  - the legal document structure,
  - cross-references
  - Exceptions
  
- Focus on - Decoding Obligation
  - machine learning and rule based techniques
  - Obligation Model to extract obligations and their attributes from HIPAA regulations
  - Augment the obligation with Facts and Definitions
  - Render the deconstructed obligations in HTML format

- **Obligation Model**
- Automate extraction of obligations and their attributes from HIPAA
- Augment the extracted obligations with relevant auxiliary information (scattered within the HIPAA document)
- Present an ownership based rendering of the extracted information in HTML format to aid stakeholders in fulfilling the obligation

- Take a significant step towards making it easier for the stakeholders to fulfill their respective obligations, while making them more accountable for the same.
- Contribute to building software systems that are not only compliant with regulations but also promote accountability.

# Obligation Model



# Examples

## Obligation

*§ 160.314 If the witness does not sign the transcript or offer corrections **within 30 days** (computed in the same manner **as prescribed under § 160.526 of this part**) of receipt of notice of the opportunity to inspect the transcript, the **witness will be deemed to have agreed that the transcript is true and accurate.***

## Right

*§ 160.306 c (2): The Secretary may investigate any other compliant filed under this section.*

## Fact

*The transcript of the testimony, exhibits, and other evidence admitted at the hearing, and all papers and requests filed in the proceeding constitute the record for decision by the ALJ and the Secretary is a Fact relevant to Obligation A.*

## Definition

*Compliance date means the date by which a covered entity must comply with a standard, implementation specification, requirement, or modification.*

## Dataset

- HIPAA Administrative Simplification, Regulation Text: 45 CFR Parts 160, 162, and 164 [2]
- Regulates the use and disclosure of personal health information

## Training

- Two Subject Matter Experts (SMEs) performed manual content analysis
- Labelled each of the statement in it as an obligation or non-obligation
- 850 obligation statements and 550 non-obligation statements.
- Each obligation statement labelled by SME to identify text fragment corresponding to *Responsible entity, Trigger, Action* and the other attributes in OM
- From the non-obligation statements, the SME annotated the statements that correspond to *Definitions* and *Facts*



## **Obligation Extraction**

- Complimentary Naïve Bayes Technique
- 5-fold cross validation

## **Attributes Extraction**

- NLP based technique
- Dependency tree of a given obligation statement by using spaCy Dependency Parser (<http://spacy.io>)

## **Obligation Augmentation**

- Identify *Definitions* and *Facts* using Complement Naïve Bayes technique and Dependency Parsing

## Rendering

- Ownership based rendering of the augmented obligation in HTML form
- Aid in establishing an explicit ownership of obligations and enhancing accountability

**Responsible Entity :** Witness

**Obligation Type:** Triggered, Time Bound

**Trigger:** If the witness does not sign the transcript or offer corrections of receipt of notice of the opportunity to inspect the transcript

**Action:** be deemed to have agreed that the transcript is true and accurate

**Deadline:** within 30 days

**Reference:** as prescribed under § 160.526 of this part

**Relevant Definition:** None

**Relevant Fact(s):** The transcript of the testimony, exhibits, and other evidence admitted at the hearing, and all papers and requests filed in the proceeding constitute the record for decision by the ALJ and the Secretary

# Initial Results

For obligation identification, we obtained a precision of 96.3% and a recall of 97.6%

Attribute	Precision (%)	Recall (%)
Responsibility Entity	77	90
Action	93	91
Trigger	76	92
Deadline	91	86
Reference	90	90.5

For identifying *Facts*, we obtained a Precision and Recall of 98.8 % and 99.4 % respectively and for *Definitions*, a Precision of 97.8 % and a Recall of 99.2 %



# Conclusion

- Proposed an Obligation Model with the purpose of understanding obligations from the perspective of accountability.
- Presented an approach to extract obligations and their attributes from HIPAA
- Augmented the extracted obligations with auxiliary information such as Facts and Definitions
- Presented an ownership based rendering of the extracted obligations in HTML format



Thank You !