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AN ONTOLOGY BASED INTERPRETATION OF LEGAL SECTION FOR DOWRY DEATH CASES IN INDIA

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Abstract:

Ontology is to describe concepts and their relationships within a domain. Indian judicial applications have enough scope of services rendered with the help of Artificial Intelligence based tools. Since adequate domain knowledge is essential for the development of Artificial Intelligence based system, identification of appropriate legal ontology has enormous importance. The authors have proposed an approach to create an-ontology-based description of legal knowledge in terms of entities, relationships, instances, and axioms from textual description of rules corresponding to Criminal Major Act on dowry death as stated in Indian Penal Code Section (IPC) 304B. The authors have evaluated the proposed ontology with some DL queries successfully.

Keywords: Dowry Death, Indian Penal Code Section 304B, natural language processing, ontology, protege.

1. INTRODUCTION

Artificial Intelligence (AI) techniques are now used in various service sectors like education [1], healthcare [2], business [3], etc., to improve analytical ability and to provide efficient information processing services. The Artificial Intelligence based agents can learn from external environment and use that knowledge to solve complex problems [4, 5]. It is therefore no surprise that AI based intelligent systems will find its rightful place in legal domain. With huge number of backlog cases [6], inadequate infrastructure, antiquated methods of storage and analysis of case records, lack of commensurate pool of expert legal professionals, etc., Indian Judicial System has compelling reasons to use Artificial Intelligence based methodologies that can assist legal professionals. Recently Artificial Intelligence based tools such as Spotdraft [7], Casemine [8], etc., are used by law firms in places such as Delhi, Mumbai, Bangalore. However, penetration of such tools and techniques in legal services in India is still quite limited. In India, legal professionals are familiar with methods and techniques to interpret facts, still find the tasks to be time-consuming.

In order to adopt AI based methodology for legal document analysis, it is necessary to adequately capture the semantics of the legal domain. In this quest, identification, and representation of ontologies of legal domain can be considered as a first step. Building ontology

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is a process of capturing domain knowledge. Ontologies are content theories that describe objects, attributes, and feasible relationships in each area of knowledge [9]. They offer potential terms for describing knowledge as a knowledge base. Knowledge base helps formal modeling, reasoning, and querying a domain [10]. The usage of ontology can aid in developing knowledge base applications that deliver prompt services to beneficiaries.

Legal cases involve facts based on legal sections or charges, i.e., Indian Penal Code Sections. While conducting legal research, legal professionals must assess all information in legal cases depending on the charges or legal sections mentioned in the case. In view of this, it is necessary to focus on the structural modeling of the legal section which in turn would assist legal professionals to quickly analyzing cases in less time. Considering the time-consuming nature of legal research, the authors intend to build the motivation and objective of this research work are to build an ontology to capture the main concepts and their connections in legal cases to prepare a legal knowledge base [11]. It would also help to draw inferences based on the semantics of legal rule as presented in the law books.

Instead of focusing on all types of legal sections, in this paper the authors have concentrated on Indian Penal Code Sections connected to crime against women. A significant rise has been noticed in domestic violence cases against women due to illegal dowry by the members of maternal houses, even leading to the death of the women [12]. This paper mainly focused on preparing a knowledge base of Indian Penal Code Section 304B (IPC 304B) [13], present in dowry death cases which have expanded rapidly in recent years.

1.1 Contribution of this work

In summary form, the contribution of this research work may be stated as below.

a) This work provides vital information about the entities and their relationship in dowry death cases.

b) This study highlights the motivation to prepare the formal model of IPC 304B, i.e., dowry death, which is available in textual form in law books, journals, statutes, etc.

c) This proposed work explains an approach to build a knowledge base for dowry death cases using ontology. It also explores several research directions to build knowledge base using ontology for dowry death cases. This concept of technological enhancement using knowledge base will assist the legal practioners to resolve more cases within a specific time frame of legal research.

2. RELATED STUDY

The first monograph on legal ontologies was released in 1995[14]. Artificial Intelligence assists in shifting the dimension of ideas with a better understanding of the types and roles of legal ontologies. The ontology-based research work conducted over legal domain in the year 2005 have discussed the following aspects of legal ontologies for structuring information, reasoning, semantic indexing, integration, interoperation and understanding domain knowledge [15]. The primary objective of legal ontologies is to transit from the abstraction levels to specific solution

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to generate meaningful structured information [16]. Hence, the core level ontology or domain conceptualization is defined as a semantically structure that encodes knowledge behind any domain [17]. It includes the central understanding of the law that can be applied across all legal domains i.e., criminal [18] and civil [19,20] legal systems. Recent contributions in legal core ontologies such as LKIF core, LRI-core and DOLCE helps to articulate the legal domain [21].

Ontologies in the legal domain capture classes, attributes, relations, rules, and axioms [22]. Domain conceptualization ontologies are used for legal information processing system [23] and case-based reasoning systems [24]. Though ontology-based models have been explored in Italian [25] and European [26] legal applications, few models focusing on Indian legal cases have been reported. Recently in [27, 28] artificial intelligence-based techniques have been used to deal with dowry death cases. In these literatures it has however been observed that though machine learning algorithms help in predicting outcomes, the features that can be used to train the machine learning models need to be further explored. In this context, identification of domain ontology can in turn help in identifying such critical features to be used in machine learning steps. Ontology may play a role in capturing the parameters to prepare dataset to train machine learning models.

Analysis of any judicial decision or proceedings is dependent on a legal section or legal charges mentioned in it. While analysing important segments in any legal case, legal professionals usually begin by identifying relevant legal acts or charges. An ontology-based domain conceptualization should therefore support interpretation of legal acts or legal rule. With this in view, while creating ontology based legal knowledge base for dowry death cases, the entities and their interrelationships mentioned in the legal sections identified by legal professionals as shown in Fig. 1. Hence, in this paper the authors have tried to develop ontology to capture major entities and their interrelationships in dowry death. In future, this proposed ontology can further be extended as knowledge base to analyse other section mentioned in dowry death cases.

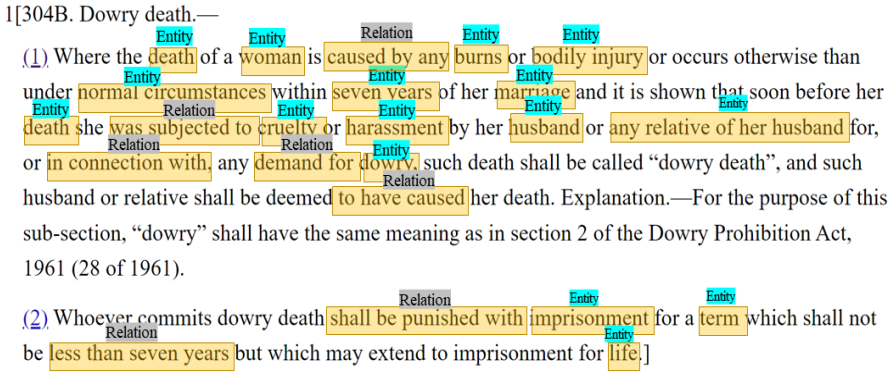

Fig. 1: Lawyer annotated legal section IPC 304B

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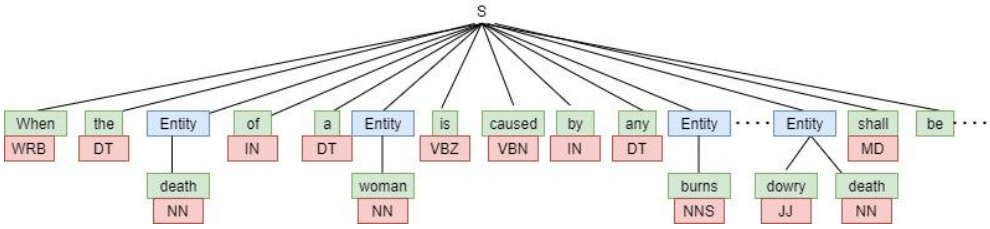
3. MATERIALS AND METHODS

The methodology includes the representation of entities, relationships, and instances using protégé tool to build an ontology to capture the knowledge of the IPC 304B on dowry death.

Fig 2: Snapshot of the parse tree (LNEE, volume 836)



Source: [30]

3.1 Origin of the work

As origin of this research work, the authors have applied NLP techniques over IPC304B to extract the major entities. The authors have used NLP based approach to extract the parameters from IPC304B to assist legal professionals to understand their instances present in dowry death cases [30]. Further, for better visualization authors Unified Modelling Language (UML) based diagrams to explain the static structure of the entities and their relationships. In this paper, the authors have taken an ontology-based approach as means of visualizing the entities, relationships and instances that are present in dowry death cases. This approach is mentioned as Step IV and Step Vas shown inFig.3. The methodology depicts the entities and their relationships that are identified with the help of parse tree in Step III.

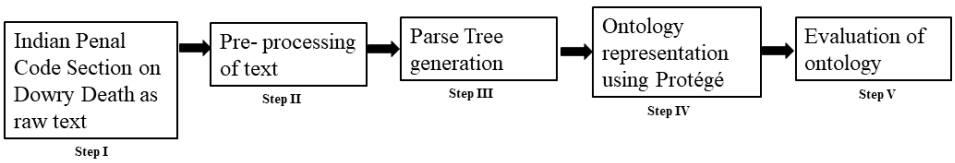


Fig 3: Stepwise depiction of the work

Step I and Step IIexhibit the description of IPC304B as it appears in law journals andtext analytics techniques to extract the parts of speech associated with the words present in the legal rule.Step III represents the words as entities as a parse tree as shown in Fig. 2, using grammar rule, regex parser [31], and domain expert. The entities stated in the grammar rule have been recommended by the domain experts.As described in [30], the authors have employed UML

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methodology to represent the entities and the relationships obtained from parse tree. In this paper, the authors provide an alternative approach to represent the entities and their relationships presented as parse tree in Step III.Hence, Step IV describe the ontology using Protege tool to represent the entities and their relationships as specified in IPC 304B. Step V describes theontology evaluation using legal professional's annotated documents on dowry death and DL enquiries.

4. ONTOLOGY OF INDİAN PENAL CODE SECTION 304B

This section discussed the formal defination of ontology along with the ontological framework of IPC304B.An ontology is a machine-readable formalisation of a domain. It is defined as six tuples[32] i.e., O=[C,H,I,R,P,A] as shown in Fig. 4.C denotes union of C^c and C^i where C^c denotes the concepts that represent entities and C^irepresents the instances. H denotes set of taxonomic relations between concepts, which define a concept hierarchy and are denoted by kind_of(c_1,c_2) meaning that c_1 is a subclass of c_2. I represents set of instances related to entities or concepts. R denotes set of non-taxonomic ontology relationships between the concepts or entities. P represents set of data properties of entities. A represents axioms and rules that helps to check consistency of the ontology and infer new knowledge using inference techniques.As formal definitions of ontology, subsection 4.1 identifies and explains tuples such as C, H, and I, i.e., Concepts, sub concepts, and instances. In subsections 4.2, 4.3, and 4.4, the remaining tuples R, P, and A, i.e., non-taxonomic relations, data properties of entities, and rules or axioms, are described. Using the open-source framework Protege 5.5.0, subsection 4.5 illustrates the ontological framework of interrelationships between the major concepts.

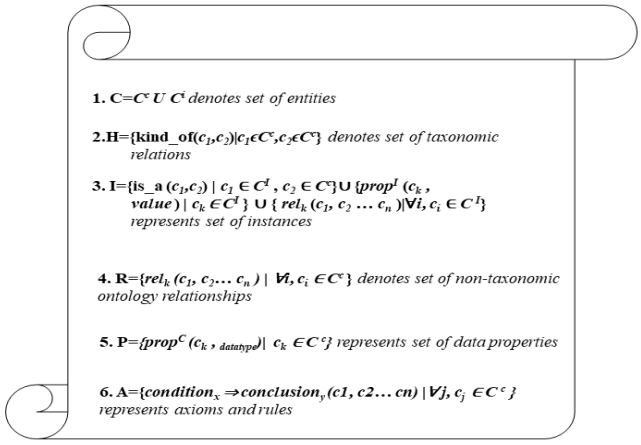

Fig 4: Fomal representation of ontology

4.1 Entities as concepts and their individuals

As discussed in origin of the work, the authors use regex parser to represent entities is listed in Table.1. Analysing the legal rule using regex capture the linguistic features of the legal rule

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and provide a better understanding of the major entities and the relations involved in dowry death cases. Entities are represented as individual units associated with attributes. Entity has a distinct existence as an independent unit, whereas concept is a generalisation of a particular set of observations. Hence, in this paper, the authors have represented the entities as concepts, a generalisation of a specific set of individuals such as Woman, Husband, Cruelty, Death, etc., having some set of attributes. To provide a generic framework to proposed ontology, entities such as Woman, Husband, Death, etc., are represented as concepts with some instances shown as individuals. The authors have used OWLViz tool to represent the major entities or concepts like Death, Woman, Cruelty, Husband or Relative of Husband, Marriage, Harassment, Dowry as shown in Fig. 5. Additionally, the authors have segregated some concepts into sub concepts as hierarchy that helps to capture the intensity of information in cases. For example, Punishment is sub divided into Fine and Imprisonment. Injury is categorised as Burn Injury and Bodily Injury,

Relative Husband is divided as Biological or Non-Biological. Biological includes those relatives who are biologically related to Husband. Some of the entities or concepts as described in law books, journals, statues, etc. are summarised in Table 2. Individuals are fundamental unit of ontology. Individuals define entities and their property values as the formal aspect of semantics.

Table 1: List of major entities of dowry death

List of words suggested By legal professionals	List of words extracted by grammar rule
death	death
woman	woman
burn	burn
bodily injury	bodily injury
Normal circumstances	Normal circumstances
Seven years	years
marriage	marriage
cruelty	harassment
harassment	husband
husband	imprisonment
Any relative of her husband	term
dowry	life
imprisonment	
term	
life	

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Table 2: Some major entities of dowry death

Concepts / Classes	Description
Husband	A male person who is legally married and in relation with his spouse.
Wife	A female person who is legally married and in relation with her spouse.
Injury	The word injury denotes any harm whatever illegally caused to any person, in body, mind, reputation or property.[33]
Death	The word "Death" denotes the death of a human being unless the contrary appears from the context.[34]

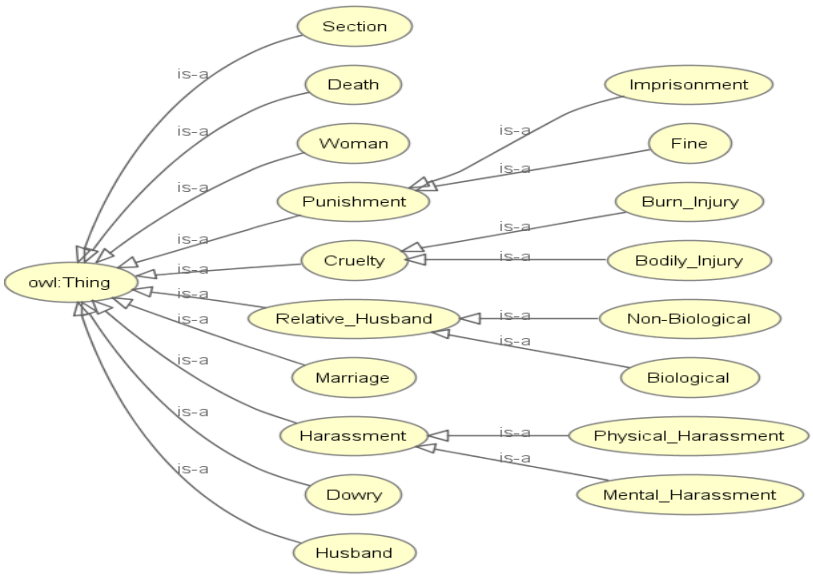

Fig 5: OWLViz of the major entities

According to the above formal definition of ontology and OWLViz of major entities as shown in Fig. 5, the set of concepts that represent entities (C^c) along with the set of taxonomic relations between concepts and some individuals are identified as:

C^c= {Section, Death, Woman, Punishment, Cruelty, Relative_Husband, Marriage, Harassment, Dowry, Husband}

H= {kind_of (Imprisonment, Punishment), kind_of (Fine, Punishment), kind_of(Burn_Injury, Cruelty), kind_of (Bodily_Injury, Cruelty), kind_of (Non_Biological, Relative_Husband),

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kind_of(Biological, Relative_Husband), kind_of (Physical_Harassment, Harassment), kind_of(Mental_Harassment, Harassment)

I= {is_a(Gold, Dowry), is_a (Hindu_Marriage_Act, Marriage, is_a (IPC, Section)} represents Gold is an instance of Dowry. Similarly, Hindu_Marriage_Act and IPC is an instance of Marriage and Section.

The above-mentioned concepts and the sub concepts represent the knowledge behind the major entities present in dowry death cases.

4.2 Objects as non taxonomic relationship

Knowledge is presented as type of non-taxonomic relationships. In this section, relationships demonstrate the connectivity among concepts. In protégé, object properties are used to define the relationships. As per domain expert in dowry death cases, the wife is compelled to give more dowry, whether monetary or property-based. As a result, in order to emphasize the relationship, the authors connect the entities "Woman" and "Dowry" with the object property "hasAskedFor". Similarly, connection between entiries "Woman" and "Cruelty" or "Harassment" is represented by "hasSubjectedTo". It explains the obejct property when the wife is subjected to "Cruelty" or "Harassment", whether physical or mental. These object properties comprehend the relationship between major facts present in dowry death cases that legal professionals extract in order to prepare their draft. Some relationships are clearly mentioned in Table 3. Table 4 shows the list of statements written in some dowry death legal judgments as suggested by legal professionals that mentioned the inferred relationships listed in Table 3.

Table 3: Object properties along with their description

Object properties/ Relationships	Type	Description
Has Accepted By	Has-a	Dowry has accepted by husband or relative of husband.
Has Asked For	Has-a	Woman has asked for dowry at the time of marriage.
Is Due To	Is-a	Death of woman is due to cruelty or harassment.
Has Charged With	Has-a	Husband has charged with legal section of dowry death.
Is Responsible For	Is-a	Husband or relative is responsible for death.
Has Caused To	Has-a	Death has caused to Woman.

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Table 4: Statements to infer relationships suggested by legal professionals from some legal documents

Case No.	Sentences	Semantically list of words suggested by legal professionals for Inferred Relations	Inferred Relation
CRA No 765 of 2013 CRA No. 512 of 2005	After six months of their marriage Minakshi was subjected to torture, cruelty and dowry demands. She paid Rs.2000/- in consideration of the happiness of the daughter but torture continued unabated.	demands, paid	**Has Asked For**
CRA No. 512 of 2005 CRA No. 407 of 2005	Feeling aggrieved, the appellant assails his conviction under Section 498A/304B of the IPC and sentence… Trial court held the appellants guilty of the offences punishable under section 498A and 304B of the Indian Penal Code…	conviction under, punishable under	**Has Charged With**
CRA No. 512 of 2005	As it appears from evidence of PW.10 Dr. A. Adhikary, who conducted the post-mortem examination of the victim's body the death of the victim was due to suicidal poisoning…	was due to	**Is Due To**
CRA No 765 of 2013	It is alleged that as a result of torture she died, and her death was caused by hanging amounting to dowry death ….	was caused	**Has Caused To**

According to the formal definition of ontology, further the relationships are represented in Protégé as

R={has Accepted By (Husband or Relative Husband, Dowry), has Asked For (Woman, Dowry, has Caused To (Death, Woman), has Charged With (Husband or Relative Husband, Section, has Occurred Within Years Of Marriage (Death, Marriage), has Resulted To(Section, Punishment), has Subjected To(Cruelty or Harassment, Woman), is Due To (Cruelty or Harassment, Death)}

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4.3 Data properties of entities

In Protégé, data properties are displayed as associations between individuals with some values. For instance, marriage is a crucial factor in dowry death cases. The husband and wife must be married then only dowry death legal section would be applicable. To symbolise this, marriage is associated with marriage acts such as the Hindu Marriage Act and the Muslim Marriage Act, etc. Hence, nuptial act of string data type is a data property associated with the entity Marriage. Likewise, other data properties of the individuals along with the entity can be represented.

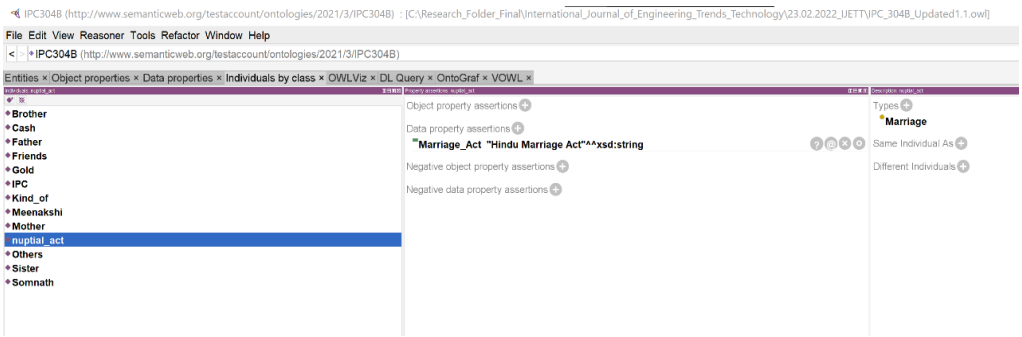

Fig 6: Snapshot of the data properties along with individual nuptial act and entity marriage

As formal ontology definition, some of the object properties along with individuals, data properties and axioms are identified as:

P= {nuptial act **(**Marriage, String), duration (Marriage, String), dowry amount (Dowry, String), section number (Section, String)} where nuptial act and duration represent the basic data type of a class Marriage. It demonstrates the marriage ceremony is valid on marriage act, and duration indicates the period of the marriage between the date of marriage and date of death. According to IPC 304B, if the marriage lasted within seven years of duration, only dowry death section is chargeable against the accused persons. Similarly, dowry amount represents the amount of dowry given or accepted by either party associated with entity Dowry as String data type. Likewise, nuptial act having value Hindu Marriage Act associated with entity Marriage. In future, more data properties added as dowry death legal documents contain additional entities such as Witness, FIR, etc. Fig. 6 represents the snapshot of the data property.

4.4 Axioms and Rules

As defined in the formal definition of ontology, rules or axioms verify the ontology's consistency to derive some inferences. Generic rules or axioms for the classification of instances of the ontology are identified as: As defined in the formal definition of ontology, rules or axioms verify the ontology's consistency to derive some inferences. Generic rules or axioms for the classification of instances of the ontology are

Identified as:

Instance (I, C^i) =>is_a (I, C^i) represents concepts C^i having instance I.

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Instance (I, H, C) =>**kind_of**(I,H, C) represents concept C having taxonomic relationships between concepts, which define a concept hierarchy.

And Object Property (I, R, C^c) represents instance I associated by non-taxonomic relation R of a concept

C^c. The condition along with conclusion of the rules is described as:

Instance(I_1,C^i) Λ Instance(I_2,C^i)…….Λ Instance(I,H,C)ΛObject_Property(I, R, C^c))=>is_a(I_1,C^i)Λ is_a(I_2, C^i)Λ….Λkind_of(I,H,C)Λ Object_Property(I, R, C^c) representing Instances I_1, I_2, I_3, etc., of classes C^i associated having some non-taxonomic relationship with class C^c and non-taxonomic relation with C(C^c U C^i**)**.

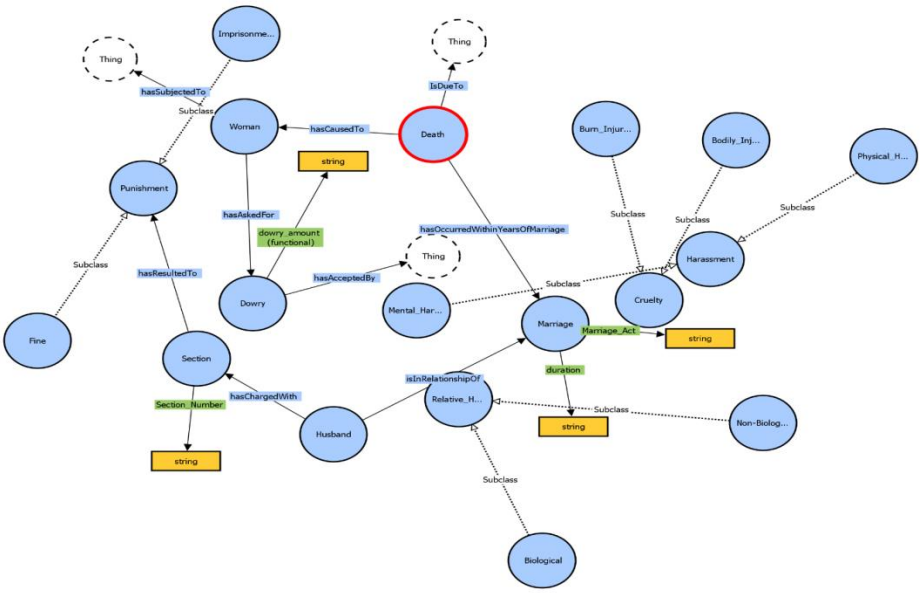
The rule is represented with an example from a case document on dowry death[35] as follows:

Instance (Somnath, Husband)=>is_a(Somnath, Husband) representing Somnath is a husband.

Instance (Meenakshi, Woman)=>is_a(Meenakshi, Woman) represents Meenakshi is a woman.

Instance(I_1, C^c) Λ Instance(I_2, C^c)Λ Object Property (I, R,C^c)=>is_a(Somnath, Husband)Λ(Meenakshi, Woman)ΛObject Property (Somnath, Meenakshi, is In Relationship Of, Marriage) represents two instances Somnath and Meenakshi as Husband and Wife associated with a relationship of Marriage. Similarly, the proposed ontology can contribute rules that represent the legal section of dowry death in structured form.

Fig 7: Ontology of IPC 304B



4.5 Ontological visualization of Indian Penal Code Section 304B

Fig. 7 depict the final ontology of the legal framework representing IPC 304B. The final ontology framework represents the knowledge connected with major entities and their object

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properties of IPC 304B. According to ontology definition from previous subsections and final ontology framework the textual rule of IPC 304B written in law journals, books, statues, etc., can be identified as:

Istance(I_1,Husband)ΛInstance(I_2,Woman)ΛObject_Property(I_1,I_2,R,C^c)=>is_a(I_1,Husband)Λis_a(I_2,Woman)ΛObject_Property(I_1,I_2,isInRelationshipOfMarriage) represents instances of Husband and Woman is in relationship of Marriage.

Istance(I_1,Biological,Relative_Husband)ΛInstance(I_2,Non_Biological,Relative_Husband)ΛObject_Property(I_1,I_2,R,C^c)=> kind_of (I_1,Non_Biological, Relative_Husband) Λ kind_of (I_2,Biological, Relative_Husband) Λ Object_Property (I_1,I_2,has Charged With, Section) represents the instances of husband or relative of husband(biological or non_biological) has charged with legal sections.

Instance(I_1,Physical_Harassment, Harassment)∨Instance(I_1, Mental_Harassment, Harassment) ∧ Object_Property (I_1,I_2,R,C^c) => kind_of (Physical_Harassment, Harassment) ∨ kind_of (Mental_Harassment, Harassment) ∧ Object_Property (I1,I2, has Caused To, Death) represents the instances of harassment (physical or mental) has caused to death.

Istance(I,Death)∧Object_Property(I,R,C^c)=>is_a(I,Death)∧Object_Property(I,hasOccurredWithinYearsOfMarriage,Mariage) represents death has occurred within some years of marriage.

Instance(I,Woman)∧Object_Property(I,R,C^c)=>is_a(I,Woman)∧Object_Property(I,hasAskedFor,Dowry) represents Woman was compelled to give dowry.

Instance(I_1,Section)∧Instance(I_2,Husband)Instance(I_3,Biological,Relative_Husband)ΛInstance(I_4,Non_Biological,Relative_Husband)∧Object_Property(I,R,C^c)=>is_a(I_1,Section)∧is_a(I_2,Husband)∧kind_of(I_3,Biological,Relative_Husband)∧kind_of(I_4,Non_Biological_Relative_Husband)∧Object_Property(I_1,I_2,I_3,I_4,hasResultedTo,Punishment) depicts the legal section charge against the husband and relative of husband leads to some Punishment.

From the aforementioned axioms, it is evident that the depicted formal statements correspond to the entities and their interactions that legal professionalsidentify when studying any dowry death cases. Thus, the formal representation of IPC304B depicts a formal structure of the statements that was available in law journals as unformatted text.

5. EVALUATION AND DISCUSSION

In this paper, the authors have used two evaluation techniques i.e., manually incorporating the captured entities and their relationships legal professional's annotated documents and secondly, used HermiT1.4.3.456 reasoner to check the consistency of the manually populated ontology with some DL queries. The authors have tested and populated the proposed ontology in terms of its effectiveness, nine case studies were conducted using dowry death judgments. Out of 9, Fig. 8 (i) and Fig.8(ii) represent the example of fragments of judgments[35,36] annotated by legal professionals and used to populate the proposed ontology with individuals from the annotated judgments manually.

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JUDGMENT

Ravi Krishan Kapur, J.

1. Both these appeals arise from the same order and are taken up for hearing in terms of the earlier orders passed by this Hon'ble Court. These appeals are directed against the judgment and order dated 20 July, 2013 passed by the Learned Additional Sessions Judge, Second Court, Barasat, North 24 Parganas in Sessions Trial No. 05(07)/2011 arising out of Sessions Case No. 07(01)/2011. In CRA 608 of 2013, the appeal is preferred against the conviction of the appellant husband, Somenath Jana under section 498A/304B of the Indian Penal Code. The connected appeal being CRA No. 765 of 2013 has been preferred against the same judgment and order insofar as it acquits the other accused persons i.e. the in-laws of the deceased daughter-in-law. By the impugned order the appellant husband has been convicted of offences punishable under sections 498A and 304B of the Indian Penal Code and has been directed to undergo rigorous imprisonment for 3 years for the offence under section 498A and to pay a fine of Rs. 2000, in default of payment of fine to suffer rigorous imprisonment for 3 months. The appellant husband has also been sentenced to rigorous imprisonment for 7 years and has been directed to pay a fine of Rs. 5000, in default to suffer further rigorous imprisonment for 6 months of the offence punishable under section 304B Indian Penal Code. Both the sentences have been directed to run concurrently.

2. Shorn of details, the case of the prosecution against the appellant husband and the other accused persons being his parents Namita Jana and Kanailal Jana i.e. mother-in-law and father-in-law of the deceased respectively is to the effect that the appellant husband was married to one Minakshi and she was subjected to cruelty and dowry demand by her husband and her in-laws. It is alleged that as a result of torture she died and her death was caused by hanging amounting to dowry death for which all three accused persons have been charged under section 498A and 304B of the Indian Penal Code (IPC).

Fig 8 (i): Fragment of Judgement on IPC 304B

JUDGMENT

Toufique Uddin, J.

1. This appeal arose out of judgment and order dated 30.8.2005 passed by the learned Additional Sessions Judge, Fast Track Court, III, Purulia, in Sessions Trial No. 81 of 2004 convicting the appellants for commission of offence under Sections 498A/304B/34 of the Indian Penal Code. In the background of this appeal, the fact in a nutshell is as follows:-

> One Sipra Sarkar sister of the complainant got married to one Sujoy Sarkar of village Parui under P.S. Pancha, district Purulia and the said marriage took place on 27th April, 2001. She died under suspicious circumstances at her in-laws' place on 2.8.2002. On 2.8.2002 the complainant received a telephonic information from his sister at about 11 a.m. to the effect that she was being extremely harassed by the members of her in-laws' family and she should be rescued immediately. The complainant conveyed his sister that he will arrange to bring her back on 3.8.2002. On the same day at 5 P.M. the husband of Sipra Sarkar conveyed that his sister was suffering coronary thrombosis. On receipt of such information the informant along with others rushed to the matrimonial home of his sister and found there his sister dead.

2. Sensing a foul play a complaint was lodged with the Police Station.

3. After investigation, the police has submitted charge sheet under Sections 498A/304B/34 of the Indian Penal Code read with Section 3 and 4 of the Dowry Prohibition Act.

4. The case was committed by the learned Magistrate to the Court of Sessions, Purulia.

5. On hearing of both sides, the learned Trial Court framed charge against the accused persons under Section 498A/304B/34 of the Indian Penal Code.

6. The contents of the charge were read over and explained to the accused person, who pleaded not guilty and claimed to be tried.

Fig 8(ii): Fragment of Judgement on IPC 304B

In this research work, total number of entities extracted is 12 and the inferred relationships are 6. As a result, the authors manually captured the entities and relationships and incorporate them with other elements of proposed ontology of dowry death legal rule and found some accuracy for capturing the number of entities and relationships for each case as shown in Fig. 8.

Additionally, while implemented with HermiT1.4.3.456, the reasoned successfully depicts the consistency of the proposed ontology and derive inferences for object properties between the entities Marriage, Dowry, Husband or Relative of Husband, Death, Woman as explained as axioms in the above-mentioned subsequent section IV E i.e., ontology of Indian Penal Code Section 304B on dowry death. Also, the authors execute range of some DL queries which can be incorporated into the knowledge base such as:

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a) Who is the Husband?

b) Who is the woman?

c) Who has forced to give some dowry?

d) Who are charged with some sections?

e) Who are the relative of husband?

f) What is the section charged?

g) What is the marriage act?

5.1 Advantages of the proposed ontology

The proposed ontology captures the entities or concepts, relationships and the instances found in dowry death legal section to some extent. It acts like a formal model as knowledge base for IPC 304B that depicts each entity, relationships between entities and instances found in dowry death documents. It emphasizes the structural model of the legal rule on dowry death. Also, the structured ontological framework can present the rules or axioms as stated in the IPC 304B as text written in law journals, statues, etc. As shown in Fig. 8 (i) and (ii), the proposed ontology is intended to serve the function of representing multiple sections as data property section number because the accused persons have been charged with other IPC sections along with 304B. As the authors concentrated on IPC 304B, the proposed ontology accurately represents the scenario until the victim (i.e., Woman or Wife) died, because an alive victim will trigger additional legal provisions under India Penal Code Sections.

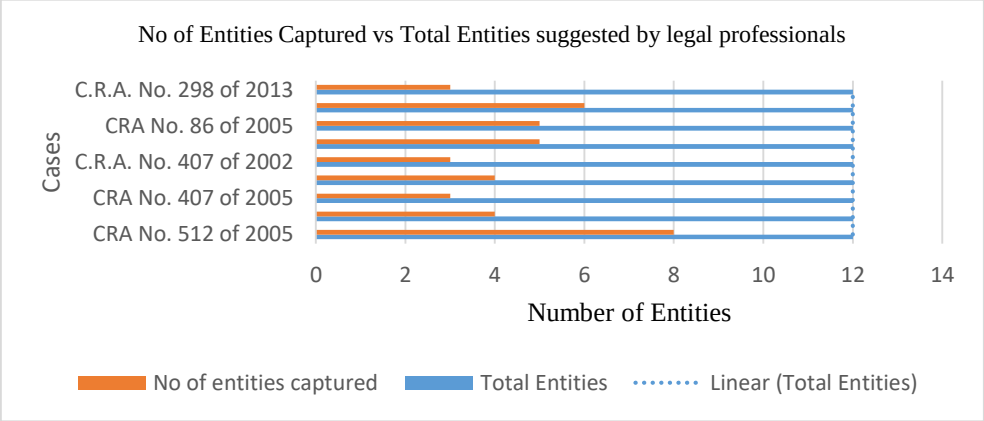

Fig 9: Number of entities captured by proposed ontology

Fig. 9 is depicting the analysis chart of the number of entities captured using the proposed ontology out of the total number of entities suggested by legal professionals. As we see the percentage of capturing the entities from the cases is within range 25% to 70%.

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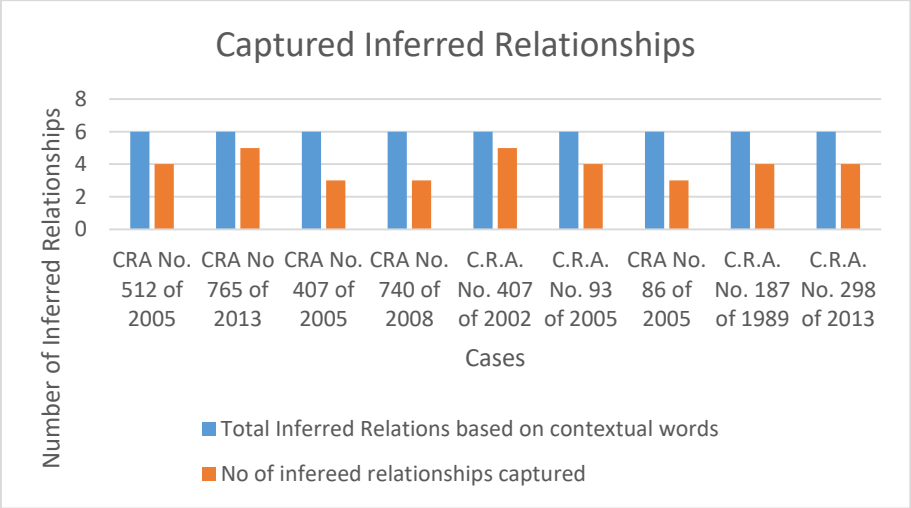

Fig 10: Number of inferred relationships captured by proposed ontology

Fig. 10 is depicting the analysis chart of the number of relationships captured using the proposed ontology out of the total number of relationships suggested by legal professionals among the entities. As we see the percentage of capturing the relationships from the cases is within range 50% to 85%.

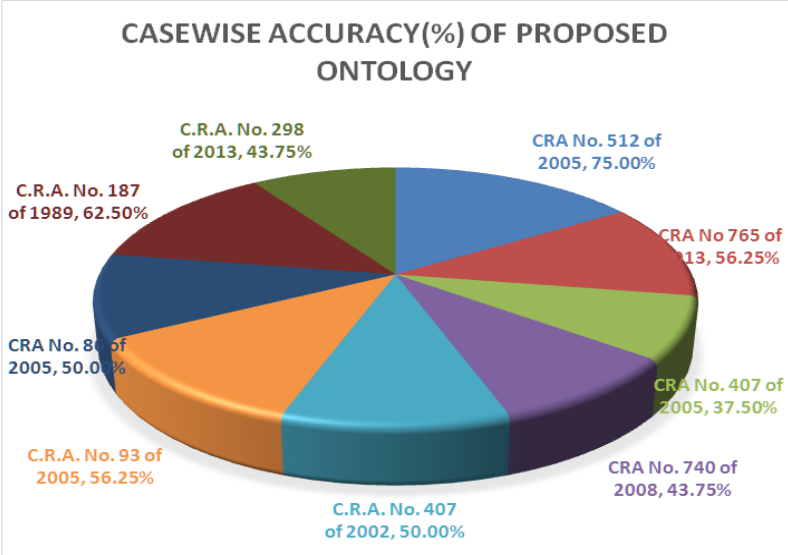

Fig 11: Accuracy (%) of case wise captured entities and relationships

As accuracy percentage of capturing the components from the cases is within range of 30% to 75% as shown in Fig. 8. In future, to enhance the accuracy level, some more entities and relationships will be necessary to enhance the ontology for the analysis of dowry death case documents is further explained in subsequent section.

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5.2 Future work

Even though the proposed ontology captures the inferences of the rules on dowry death, there are certain limitations of the proposed ontological model. There are certain object properties in the proposed ontology are insufficient for drawing additional inferences from the knowledge base, as they require the inclusion of additional entities such as evidence, witnesses, FIR, charge sheets, etc. Also, the dowry death documents have other charges like murder, homicide, suicide, etc. Though the proposed framework addresses multiple sections as data property, it requires additional object properties, individuals, and data properties to represent ontology on other charged sections against the accused persons. The authors have found the various other sections stated in dowry death cases. As this research work is concentrating on IPC 304B, analysing dowry death cases also require the ontological framework for other penal code sections with IPC304B. As a result, our proposed ontology can serve as a starting point for a variety of research projects aimed at developing legal ontologies to analyse dowry death cases. This research work may be expanded in the future to include other criminal sections of Indian law. Also, the entities and their relationships are used to create a suitable dataset that is readily convertible into domain specific knowledge base. This dataset will help in analysing the decisions passed in judgments for the victims of dowry death using Artificial Intelligence techniques like machine learning.

6. CONCLUSION

The Indian Penal Code Sections in criminal statutes, acts, periodicals, etc., are in text form. There are limited tools and techniques for automated processing of text of IPC 304B to capture the parameters present in dowry death. From the review of relevant literatures, the authors have found that more research can be focused on capturing the meaningful information to analyse the dowry death cases. An ontology-based domain conceptualization serves the purpose of capturing the major entities and their interrelationships. The proposed ontology will serve as a knowledge base for dowry death cases. In future, this proposed ontology will further extend with some more entities, instances and relationships which may result in analysis and formation of rules to develop some Artificial Intelligence based tools.

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