Fact Investigation and Proof Standards in Legal Argumentation

Martín O. Moguillansky (mom@cs.uns.edu.ar)
Socio-Juridical and Artificial Intelligence Research Lab (JuriSIA)
Institute for Research in Computer Science and Engineering (ICIC)
National Council of Scientific & Technical Research (CONICET)
Universidad Nacional del Sur (UNS) – ARGENTINA

***Abstract*—A logical framework is presented to model legal interpretation and bring an appropriate construction of legal arguments. Reasoning with assumptions allows the construction of hypotheses. This is proposed in the context of legal procedures' dynamics, where the framework evolves as part of the investigation prior to each trial instance. Two gender biased legal cases from the Argentinian jurisprudence are analysed in the light of the proposed theory. Afterwards, some proof standards for civil law systems are discussed as a way to define a specialised dialectical argumentation semantics. We claim that the application of the proposed theory would bring software assistance for controlling the influence of external factors of the law in the investigation of a legal case.**

Introduction

We introduce an argumentation framework based on [1] for constructing arguments upon a given legal interpretation [2]. The proposal serves for building the theoretic fundamentals of further recommender systems for assisting the legal reasoning activity. We claim that such alternative may be useful as an automatic correctness control for the legal argumentation and for identifying the influence of external factors of the law when justifying legal decisions.

This article is founded upon some particularities of the civil (or continental) law system –as alternative to the common law. That means that current decisions are bound to some precedents at judge's discretion, as an alternative to a fully case-based reasoning system. Civil law systems formalise rules from legal codes and other minor laws promulgated by the legislature. In addition, common sense generalization rules (CSG) are proposed by judges at discretion, as well as subsumption rules where judges assume that a concrete premise is a particular case of a more general concept.

Such high discretionary power of judges shows a sort of subjective behavior of the law that is accepted in our system by trusting upon the so called *rational sound criticism* of judges. By relying upon the judge tenure, which involves an impartiality commitment, the system very often allows decisions –funded upon legal interpretations– that are clearly influenced by factors considered external to the law, such as personal ideology or other external powers. Gender biased decisions are a notable example in that sense, for instance, whenever it is presumed that a woman has given sexual consent unless there are proven signs of violence.

Whenever biased decisions appear, the legal case is normally appealed due to arbitrariness.

That is desirable towards justice achievement, but the biased decision should be avoided beforehand since an obvious appeal process goes in detriment of the economy of the legal process whose final decision is delayed, overcharging the system and carrying additional costs.

The argumentation theory we propose allows to represent the aforementioned particularities of the Argentinean system of justice and looks forward to capture biased decisions in advance. The concept of interpretation involves the ascription of meaning to texts. Upon such idea, different specialised legal interpretation techniques, or *canons*, has been classified [3]. In this article, we allow the representation of legal interpretations as a way to specify the "glue" among rules used for constructing arguments. The potential of this proposal is that legal interpretations are formalised through a logical structure that is automatically incorporated when referring to a legal precedent. In that sense, the pretended argumentation for the actual case ends up affected by the precedent's interpretation, beyond being –or being not– part of the original mental state of the judge.

In addition, we also discuss some alternatives of standards of proof for civil law systems as a way for restricting the discretionary power and concretising the rules of rational sound criticism of judges towards formal limitation of subjectivity in judges' decisions. In summary, our proposal may bring the theoretic fundamentals for implementing intelligent systems capable of assisting judges' reasoning activity, by recognising, and making aware in advance, whenever a biased decision is about to be taken.

The Framework

Legal interpretations [4], [5], [6] affect the construction of the argumentation for a decision and following a precedent implies necessarily the observation of its inner interpretations. This is a keystone in our theory [1] that does not necessarily hold in the real practice of legal reasoning in civil law systems.

We rely upon propositions which are bearers by themselves of truth and falsity. For identifying propositions in an abstract manner, we will rely upon (possibly sub-indexed) greek letters. Well formed formulæ $\varphi \in \mathcal{L}$ in a language $\mathcal{L}$ identify 1) literals, *i.e.*, predicate letters like $\alpha \in \mathcal{L}$ or their negation, $\neg\alpha \in \mathcal{L}$, and 2) formulæ constructed through the conjunction of literals in the left-hand side and a single literal as its right-hand side, such that φ is a rule like $\alpha_1 \wedge \ldots \wedge \alpha_n \rightarrow \beta$ (with $n \geq 1$). Deduction in $\mathcal{L}$ will be represented through the operator $\vdash$ which will rely upon *modus ponens* as its inference rule. Thus, given $\Gamma = \{\alpha, \alpha \rightarrow \beta\}$, we have that $\Gamma \vdash \beta$ holds. Next we define legal interpretations $\mathcal{I}$ through a special structure $\langle \mathcal{L}, \Pi^{\mathcal{I}}, \underline{\cdot}^{\mathcal{I}} \rangle$ containing the language $\mathcal{L}$, a predicate domain set $\Pi^{\mathcal{I}}$ registering literals standing for $\mathcal{L}$-propositions, and a subsumption function $\underline{\cdot}^{\mathcal{I}}$ relating each $\Pi^{\mathcal{I}}$ predicate to a set of literals from $\Pi^{\mathcal{I}}$ such that for any pair of propositions $\alpha, \beta \in \Pi^{\mathcal{I}}$, $\alpha \in \underline{\beta}^{\mathcal{I}}$ stands for α is subsumed by β. The subsumption function allows to represent the *subsumption* relation $\alpha \sqsubseteq \beta$, a special operator indicating that the truth of a proposition (α) enforces, or supports, the truth of a second proposition (β). Such a support may be also seen as a way to interpret that the first predicate is more concrete than the second more general predicate. It is important to note however that this sort of truth-enforcing operator is subjective in the sense that it depends on the criterion of the judge who adheres to such an interpretation. Therefore, a different judge may disagree and thus, a subsumption may be seen as a sort of defeasible implication.

Subsumtions may capture complex instantiations. In a well known example, Hart [7] proposed the analysis of application of a general rule like *it is forbidden to take a vehicle into the public park* to different instances of it like taking a bike, a car or an ambulance into the public park. We will consider a pair of propositions, α for *it is forbidden to take an ambulance into the public park* and β for *it is forbidden to take a vehicle into the public park*. Note that β is more general than α since ambulances may be seen as a particular type of vehicle. Defining the subsumption $\alpha \in \underline{\beta}^{\mathcal{I}}$ or equivalently $\alpha \sqsubseteq \beta$ in the context of a legal interpretation $\mathcal{I}$, we will be clearly defending the position in which the entrance of an ambulance is not allowed given that it is a special kind of forbidden vehicle.

The idea behind truth-enforcing subsumption relations is to allow a way of representing subjective inference for reasoning as it is usually done in legal argumentation. That is, having a legal interpretation $\mathcal{I}$ where $\alpha \sqsubseteq \beta$ holds would allow the inference of γ from a set like $\{\alpha, \beta \rightarrow \gamma\}$. The use of negated symbols in subsumptions will allow to state that the truth of a proposition can imply the preclusion of truth of a second one. Thus, $\alpha \sqsubseteq \neg\beta$ would serve for stating that α precludes β's truth given that α enforces the truth of $\neg\beta$. We will allow the use of the *top symbol* $\top$ for representing *assumptions*. Thus, a subsumption like $\top \sqsubseteq \alpha$ will allow to assume the proposition behind the predicative letter α to be truth according to the subjective criterion of the judge. Assumptions will be useful to hypothesize. In addition, we use the *bottom symbol* $\perp$ for representing "subjective contradictions", thus $\alpha \sqsubseteq \perp$ states a falsity for the proposition behind the predicative letter α.

The semantics for legal interpretations can be specified through a satisfaction relation $\models^{\mathcal{I}}$ such that $\alpha_1 \models^{\mathcal{I}} \alpha_n$ *iff* there is a sequence $\alpha_1 \in \underline{\alpha_2}^{\mathcal{I}}$ and $\alpha_2 \in \underline{\alpha_3}^{\mathcal{I}}$ and $\ldots$ and $\alpha_{n-1} \in \underline{\alpha_n}^{\mathcal{I}}$, with $n \geq 1$. This includes the particular cases:

- $\models^{\mathcal{I}} \alpha$ *iff* $\top \models^{\mathcal{I}} \alpha$ (α's truth is assumed).
- $\beta \models^{\mathcal{I}} \perp$ *iff* both $\beta \models^{\mathcal{I}} \alpha_1$ and $\beta \models^{\mathcal{I}} \alpha_2$, and $\{\alpha_1, \alpha_2\} \vdash \perp$ hold (β is contradictory and $\mathcal{I}$ is incoherent).
- $\models^{\mathcal{I}} \perp$ *iff* there is some α such that $\models^{\mathcal{I}} \alpha$ and $\alpha \models^{\mathcal{I}} \perp$, or equivalently $\mathcal{I} \models \perp$ ($\mathcal{I}$ has contradictory assumptions and $\mathcal{I}$ is inconsistent).
- $\Gamma \models^{\mathcal{I}} \Upsilon$ *iff* for every $\alpha \in \Upsilon$ there is some $\beta \in \Gamma$ such that $\beta \models^{\mathcal{I}} \alpha$.

In particular, a set $\Gamma \subseteq \Pi^{\mathcal{I}}$ is consistent, noted $\Gamma \not\models^{\mathcal{I}} \perp$ *iff* there are no pair $\gamma_1, \gamma_2 \in \Pi^{\mathcal{I}}$, such that $\Gamma \models^{\mathcal{I}} \gamma_1$ and $\Gamma \models^{\mathcal{I}} \gamma_2$, and $\{\gamma_1, \gamma_2\} \vdash \perp$ hold.

For instance, according to the aforementioned Hart's example, assuming γ as *the safety of pedestrians is enforced* standing for the *ratio legis* –the intention behind the norm– of β, we will have $\beta \sqsubseteq \gamma$. But then, since an ambulance may be required in the park for emergencies, we may assume that prohibiting its entrance will preclude the truth of γ, which implies $\alpha \sqsubseteq \neg\gamma$. Afterwards, $\{\alpha, \beta\} \models^{\mathcal{I}} \{\gamma, \neg\gamma\}$, and since $\{\gamma, \neg\gamma\} \vdash \perp$ we have that $\{\alpha, \beta\} \models^{\mathcal{I}} \perp$, which means that according to the legal interpretation $\mathcal{I}$, α and β represent contradictory propositions, or equivalently, $\{\alpha, \beta\}$ is an inconsistent set. This shows a potential automatic control for antinomies in interpretations, by awareing the user that by modeling $\alpha \sqsubseteq \beta$ in such circumstances would render an inconsistent proposition $\alpha \models^{\mathcal{I}} \perp$.

The consideration of predicative letters as an abstract manner to refer to propositions, renders the need to specify the process of instantiation. Having $\mathcal{I} \models \alpha \sqsubseteq \beta$ would allow the inference $\{\alpha, \beta \rightarrow \gamma\} \models^{\mathcal{I}} \gamma$. However, since α is more concrete than β, it is natural to expect a more concrete inference related to α. For instance, let α be *Lucía's is a gender violence case*, β be *gender violence case* and γ be *investigation of sexual antecedents is not allowed*. Since α supports β through the subsumption $\alpha \sqsubseteq \beta$, it is natural to assume that the subject in α replaces the tacit subject in the consequence γ of the rule $\beta \rightarrow \gamma$. Hence, the natural consequence should be a proposition like *investigation of sexual antecedents is not allowed in Lucía's case*, say γ'. Thus, we can assume that $\mathcal{I} \models \gamma' \sqsubseteq \gamma$. Observe that γ' is a concrete version of γ which takes the subject from the support α by the time the inference is constructed. This means that the recognition of the corresponding concrete proposition γ', among all the propositions that may be subsumed by γ, can be univocally specified through a functional notation like $\mathcal{I} \models \gamma' = \gamma[\beta/\alpha]$ (inspired by the usual notation of substitution in mathematics). Finally, we can write $\{\alpha, \beta \rightarrow \gamma\} \models^{\mathcal{I}} \gamma[\beta/\alpha]$ or equivalently, $\{\alpha, \beta \rightarrow \gamma\} \models^{\mathcal{I}} \gamma'$.

From a philosophical viewpoint, we will structure the construction of legal arguments by relying upon the Aristotelian notions of major and minor premises as a way to organize in general and specific statements, respectively, the contributions in an argument towards its conclusion. Technically speaking, the formal construction of our legal argument relies upon recursion, where arguments are defined upon subarguments (arguments contained in an argument) towards an ultimate and primitive subargument whose only subargument is itself.

Given a legal interpretation $\mathcal{I} = \langle \mathcal{L}, \Pi^{\mathcal{I}}, \underline{\cdot}^{\mathcal{I}} \rangle$, a structure $\mathcal{A} = \langle P_m, P_M, \gamma \rangle$ is a legal argument for γ in the light of $\mathcal{I}$, in short, $\mathcal{A} \in \mathbb{A}_{\mathcal{I}}$ *iff*

- $P_m \subseteq \Pi^{\mathcal{I}}$,
- $P_M \subseteq (\Pi^{\mathcal{I}} \wedge \ldots \wedge \Pi^{\mathcal{I}} \rightarrow \Pi^{\mathcal{I}})$,
- $\varphi \in P_M$ is the top rule $\alpha_1 \wedge \ldots \wedge \alpha_n \rightarrow \beta$,
- there is a set of support $\{\alpha'_1, \ldots, \alpha'_n\} \subseteq \Pi^{\mathcal{I}}$

such that $\mathcal{I} \models \gamma = \beta[\alpha_1/\alpha'_1, \ldots, \alpha_n/\alpha'_n]$,

- for each $\alpha'_i \in \Pi^{\mathcal{I}}$ either:
  - $\alpha'_i \in P_m$, or
  - there is an argument $\mathcal{B}_i = \langle P^i_m, P^i_M, \alpha'_i \rangle$, such that $P^i_m \subseteq P_m$ and $P^i_M \subset P_M$. (Each $\mathcal{B}_i$ is a subargument of $\mathcal{A}$.)
- $\mathcal{A}$ satisfies minimality *iff*
  - $\alpha \in P_m$ *iff* either $\alpha = \alpha'_i$ or $\alpha \in P^i_m$, and
  - $\varphi' \in P_M$ *iff* either $\varphi' = \varphi$ or $\varphi' \in P^i_M$.
- $\mathcal{A}$ satisfies consistency *iff* $\{\gamma, \alpha'_1 \ldots \alpha'_n\} \cup P_m \not\models^{\mathcal{I}} \bot$

The top of an argument follows the construction presented in [8] where an argument's conclusion, as the *ultimate probandum*, is assumed to be split in (probably several) *penultimate probanda* for constructing reasoning chains standing for the branches in a tree structure. As an abstract example, let $\mathcal{I}$ be an interpretation defining the subsumptions $\beta_1 \sqsubseteq \alpha_2$, $\beta_2 \sqsubseteq \alpha_4$, and $\gamma_1 \sqsubseteq \alpha_1$. Let $(\alpha_2 \wedge \alpha_3 \rightarrow \alpha_1)$ and $(\alpha_4 \rightarrow \alpha_3)$ be two formulæ. Thus $\mathcal{A}_1 = \langle \{\beta_1, \beta_2\}, \{(\alpha_2 \wedge \alpha_3 \rightarrow \alpha_1), (\alpha_4 \rightarrow \alpha_3)\}, \gamma_1 \rangle$, where $\gamma_1 = \alpha_1[\alpha_2/\beta_1, \alpha_3/\alpha_3[\alpha_4/\beta_2]]$. Observe that $\mathcal{B}_1 = \langle \{\beta_2\}, \{\alpha_4 \rightarrow \alpha_3\}, \gamma_3 \rangle$ is a subargument of $\mathcal{A}_1$, where $\gamma_3 = \alpha_3[\alpha_4/\beta_2]$, assuming that $\gamma_3 \sqsubseteq \alpha_3$.

We will identify counterarguments through conflicts between their conclusions. The nature of our framework allows to define counterarguments through rebuttals or underminers, undercuts cannot be constructed due to restrictions on the argument's conclusion, however, such cases will be captured as rebuttals once the conclusion is instantiated. Thus, given two arguments $\mathcal{A}, \mathcal{B} \in \mathbb{A}_{\mathcal{I}}$, we say $\mathcal{A}$ rebuts $\mathcal{B}$ *iff* $\mathcal{A} = \langle \mathcal{P}_M, \mathcal{P}_m, \alpha \rangle$ and there is some subargument $\mathcal{B}'$ of $\mathcal{B}$ such that $\mathcal{B}' = \langle \mathcal{P}_M{}', \mathcal{P}_m{}', \beta \rangle$ and $\{\alpha, \beta\} \models^{\mathcal{I}} \bot$. In addition, we say that $\mathcal{A}$ undermines $\mathcal{B}$ *iff* there is some premise $\gamma \in \mathcal{P}_m{}'$ such that $\{\alpha, \gamma\} \models^{\mathcal{I}} \bot$.

A tuple $\Sigma = \langle \mathcal{R}, \mathcal{C} \rangle$ is the knowledge base (KB) of a legal case *iff* the rule base are represented through a set $\mathcal{R}$ of $\mathcal{L}$-formulæ and the case data through a set $\mathcal{C}$ of $\mathcal{L}$-literals. The rule base is internally organized through a pair $\mathcal{R} = \langle \mathcal{N}, \mathcal{G} \rangle$ where $\mathcal{N}$ is the set of legal norms stemming from the underlying legal system and $\mathcal{G}$ the set of common sense generalizations referred by judges. On the other hand, the case data is internally organized through a pair $\mathcal{C} = \langle \mathcal{E}, \mathcal{H} \rangle$ where $\mathcal{E}$ is the set of $\mathcal{L}$-literals standing for evidence data and $\mathcal{H}$ the set of $\mathcal{L}$-literals standing for assumptions.

A function $\mathfrak{h}(\mathcal{I}) \subseteq \Pi^{\mathcal{I}}$ identifies the *set of assumptions* from $\mathcal{I}$ *iff* ($\alpha \in \mathfrak{h}(\mathcal{I})$ *iff* $\models^{\mathcal{I}} \alpha$). We will recognize the set of arguments constructed from an underlying knowledge base through the notion of legal argumentation instance. Given a $\Sigma = \langle \mathcal{R}, \mathcal{C} \rangle$, where $\mathcal{C} = \langle \mathcal{E}, \mathfrak{h}(\mathcal{I}) \rangle$, and $\mathcal{I}$ is a legal interpretation, a set $\mathbf{A}_{\mathcal{I}}(\Sigma) \subseteq \mathbb{A}_{\mathcal{I}}$ is the (legal) argumentation instance of Σ in the light of $\mathcal{I}$ *iff* it follows:

- $\langle \mathcal{P}_M, \mathcal{P}_m, \alpha \rangle \in \mathbf{A}_{\mathcal{I}}(\Sigma)$ *iff* $\langle \mathcal{P}_M, \mathcal{P}_m, \alpha \rangle \in \mathbb{A}_{\mathcal{I}}$, $\mathcal{P}_m \subseteq \mathcal{C}$ and $\mathcal{P}_M \subseteq \mathcal{R}$.

Now we are able to recognise the different types of arguments according to the nature of inner components regarding a given legal argumentation instance. Thus, given a KB Σ and its instance $\mathbf{A}_{\mathcal{I}}(\Sigma) \subseteq \mathbb{A}_{\mathcal{I}}$, an argument $\mathcal{A} \in \mathbb{A}_{\mathcal{I}}$ such that $\mathcal{A} = \langle \mathcal{P}_M, \mathcal{P}_m, \alpha \rangle$ is:

- **evidential** *iff* $\mathcal{A} \in \mathbf{A}_{\mathcal{I}}(\Sigma)$ and $\mathcal{P}_m \subseteq \mathcal{E}$,
- **hypothetical** *iff* either
  - **lex ferenda (external)** *iff* $\mathcal{P}_M \not\subseteq \mathcal{R}$ and $\mathcal{A} \notin \mathbf{A}_{\mathcal{I}}(\Sigma)$, or
  - **lex lata – hypothesis** *iff* $\mathcal{P}_m \not\subseteq \mathcal{E}$, and either,
    - **internal** *iff* $\mathcal{A} \in \mathbf{A}_{\mathcal{I}}(\Sigma)$ and there is some $\alpha \in \mathcal{P}_m$ such that $\alpha \in \mathfrak{h}(\mathcal{I})$, or
    - **external** *iff* $\mathcal{P}_m \not\subseteq \mathcal{C}$, and $\mathcal{A} \notin \mathbf{A}_{\mathcal{I}}(\Sigma)$.

For fact investigation and probative argumentation (proof of facts) we are particularly interested in hypothetical lex lata arguments, *i.e.*, hypotheses. These arguments are constructed by combining evidence and assumptions in a rational manner. As is explained in [8], *"The value of a new hypothesis to an investigator rests not only on its ability to explain evidence she already has, it may also allow her to generate new lines of inquiry that have not been suggested by other hypotheses"*.

External hypotheses are built upon assumptions that have not been yet considered in the legal case. In our theory an external hypothesis is handled along with a minimal model for it, *i.e.*, a legal interpretation that considers only the necessary elements for the hypothesis to be successfully constructed. A dynamic operation, usually based upon belief revision, will ultimately incorporate the necessary elements of the hypothesis while merging appropriately the minimal model into the legal interpretation of the case. As a result, the legal interpretation is extended and the external hypothesis turns into internal [1].

For hypotheses acceptability, assumptions should not be in conflict with evidence, but also, makes necessary to observe that no hypothesis should contradict a piece of evidence.

AI Assistance for Fact Investigation

Lucía Pérez. Case 4974, 26/11/18.

On October 8th of 2016 Lucía's corpse was taken by the accused, Farias, Maciel and Offidani, to a health center. Lucía had been hours before at Farias' house where she was sexually abused after having used drugs.

According to the prosecutor, early that day, Farias and Offidani picked up Lucía (16) nearby her address and went to Farias' with the objective of sexually abusing her knowing she was a drug addict. Farias gave her undertermined quantities of cocaine and marijuana and taking advantage of her vulnerable situation (she could not give consent) she was sexually abused showing physical lesions that provoked her decease due to toxic asphyxia. Afterwards, Offidani reached the place to help Farias moving the corpse to the hospital.

The sentence dictated in November of 2018 absolved the three accused of sexual abuse and femicide. Farias and Offidani were convicted of selling drugs to minors. Maciel was absolved.

The judge validated the proofs on sexual consent from testimonies that ensured Lucía's strong personality and Lucía's sexual antecedents which were presumed from her whatsapp messages. According to the judge: *"Lucía did not appear to be a teenager that could be easily subjected to sexual activity without consent"*.

According to Argentinean Crime Code – Art. 80.11 (law 26791), femicide crime (α_1) is a female killing (α_2) concurring gender violence (α_3). While a sexual activity without consent (α_4) qualifies as gender violence according to Art. 5.3 (law 26485). Formally, $\alpha_2 \wedge \alpha_3 \rightarrow \alpha_1$ and $\alpha_4 \rightarrow \alpha_3$.

Considering Lucía's killing (β_1) as a piece of evidence, the defense's hypothesis about Lucía's femicide (γ_1) sustains from the assumption that Lucía did not gave sexual consent (β_2). The subsumptions $\beta_1 \sqsubseteq \alpha_2$, $\beta_2 \sqsubseteq \alpha_4$, and $\gamma_1 \sqsubseteq \alpha_1$, hold. Afterwards, since β_2 is an assumption, a hypothesis is configured: $\mathcal{A}_1 = \langle\{\beta_1, \beta_2\}, \{(\alpha_2 \wedge \alpha_3 \rightarrow \alpha_1), (\alpha_4 \rightarrow \alpha_3)\}, \gamma_1\rangle$. Observe that $\mathcal{B}_1 = \langle\{\beta_2\}, \{\alpha_4 \rightarrow \alpha_3\}, \gamma_3\rangle$ is a subargument of $\mathcal{A}_1$, where $\gamma_3 = \alpha_3[\alpha_4/\beta_2]$.

Sexual antecedents (α_5) and strong personality (α_6) are taken as a common sense generalization to infer sexual consent (α_7). That is, $\alpha_5 \wedge \alpha_6 \rightarrow \alpha_7$. Considering Lucía's whatsapp messages β_3 and testimonies about Lucía's personality β_4 as two valid pieces of evidence, the judge interpreted the subsumptions: $\beta_3 \sqsubseteq \alpha_5$ and $\beta_4 \sqsubseteq \alpha_6$. This configures an evidential argument: $\mathcal{A}_2 = \langle\{\beta_3, \beta_4\}, \{\alpha_5 \wedge \alpha_6 \rightarrow \alpha_7\}, \gamma_2\rangle$, where γ_2 stands for Lucía gave sexual consent, given the subsumption $\gamma_2 \sqsubseteq \alpha_7$ which makes the instantiation $\gamma_2 = \alpha_7[\alpha_5/\beta_3, \alpha_6/\beta_4]$ hold.

Observe that $\mathcal{A}_2$ is undermining $\mathcal{A}_1$ given that $\{\gamma_2, \beta_2\} \models^{\mathcal{I}} \perp$ and since $\mathcal{A}_2$ is evidential and $\mathcal{A}_1$ is a hypothetical due to β_2 being an assumption, $\mathcal{A}_2$ finally defeats $\mathcal{A}_1$ by defeating also the subargument $\mathcal{B}_1$.

CIDH LNP vs. Argentina, C.1610/07, 16/08/11.

On October 3rd of 2003, LNP (15) was sexually abused by three young "criollos" of between 17 and 20 years old. They took her to the back of the local church and facing the door, while the elder man raped her, the other two men assisted him blocking the sight of the scene with their jackets. Immediately after the act, LNP went to the police statement where lesions and fresh blood in the girl's anus were confirmed product of a violent sexual act.

In the sentence of first instance, the judges considered that there existed sexual consent according to testimonies about sexual antecedents of the victim and that since the sexual act occurred in a quite transited place of the town, it seemed suspicious that no earwitnesses were presented to the court. In addition, the judge ensured that rape should not be confused with the violence of a sexual act, and that the lesions confirmed by the police would have occurred due to the "impetus and youth of the active subject".

In sum: there is a common sense generalization rule $\alpha_5 \wedge \alpha_9 \rightarrow \alpha_7$, where sexual consent ($\alpha_7$) is implied from sexual antecedents of the victim (α_5) and absence of resistance to the sexual act (α_9). The judge supported the premises through the subsumptions $\beta_5 \sqsubseteq \alpha_5$ and $\beta_6 \sqsubseteq \alpha_9$, where β_5 stands for testimonies of the accused about LNP's sexual reputation and β_6 for no earwitnesses were found.

This can be configured in an evidential argument like: $\mathcal{A}_3 = \langle\{\beta_5, \beta_6\}, \{\alpha_5 \wedge \alpha_9 \rightarrow \alpha_7\}, \gamma_4\rangle$, where γ_4 stands for LNP gave sexual consent, given the subsumption $\gamma_4 \sqsubseteq \alpha_7$ which makes the instantiation $\gamma_4 = \alpha_7[\alpha_5/\beta_5, \alpha_9/\beta_6]$ hold.

The case reached the Inter-American Court of Human Rights (CIDH). The appealed sentence determined that the court of first instance violated several human rights due to discrimination and gender biased reasoning. Particularly, they proposed that neither the absence of resistance nor the sexual antecedents of a gender violence victim show anything with regards to the sexual consent.

This can be formalised by defining both propositions, α_5 and α_9, as incoherent which ends up affecting the usage of the common sense generalization rule $\alpha_5 \wedge \alpha_9 \rightarrow \alpha_7$. That is, $\alpha_5 \sqsubseteq \bot$ and $\alpha_9 \sqsubseteq \bot$ hold, and thus, both $\beta_5 \models^{\mathcal{I}} \bot$ and $\beta_6 \models^{\mathcal{I}} \bot$ also hold. Consequently, $\mathcal{A}_3$ cannot be constructed given it violates inner consistency of the legal argument definition.

Proof Standards

In the very spirit of Freeman and Farley [9], Gordon and Walton's Carneades [10], [11] presented a formal model of argument structure and evaluation that applies proof standards for determining the defensibility of arguments, *i.e.*, the conditions of arguments to be undefeated. A common law's natural set of five standards of proof cover a progressive enforcement of the required conditions for evaluating legal arguments. The approach is mainly focused on the evaluation of pro and con arguments through the concept of weight of an argument, which is given by its weakest premise. This can be assigned either through a computed grade of certainty given to each premise, or as a more subjective weight assigned by an audience to each argument.

In civil law systems the responsibility of proof evaluation relies upon a more general and ambiguous concept: rational sound criticism. A problem that arises from such ambiguity is an overloaded subjectivity that usually leads to an excess of interpretation discretion. The risk, in short, is to end up with an arbitrary decision.

In the last decade, the discussion about alternatives to reformulate the concept of rational sound criticism has strengthened the proposal to include proof standards. In this sense, Ferrer Beltrán [12] has proposed a list of six proof standards for the civil law. The main difference with previous proposals is the inclusion of a dimension of probative weight: a grade of confirmation about the elements of proof used to construct the hypotheses. *Id est*, it is a grade of success in the light of the support of the elements of proof. In this sense, we can say that the solider the support, the greater the grade of confirmation. Hence, the probative weight measures a grade of completeness on the relevant proof, and thus has more to do with the question: are the elements of proof contained in the expedient of the case? This idea is based on the Keynes concept of "weight of arguments" for referring to the quantity of relevant evidence cited in the premises.

On the other hand, it is considered a parallel dimension of evaluation referred as probative value: a grade of certainty of a hypothesis, and is mostly useful for comparing alternative hypotheses regarding their grade of effectivity for explaining facts. However, no concrete method is proposed for its implementation.

Inspired by both aforementioned models, the following five standards are proposed in the light of the framework formalised here:

1) the strongest defensible pro argument outvalues (is better explanation of facts than) the strongest defensible con argument.
2) verifies 1 and the strongest defensible pro argument has full probative weight.
3) verifies 2 and the difference of probative values between the strongest defensible pro and con arguments exceed a given threshold.
4) verifies 3 and the strongest defensible con argument has not full probative weight.
5) verifies 4 and all the facts of the case are explained by the pro arguments, and all the con arguments are defeated.

A simple approach for implementing the probative value dimension is to measure the inner components of the hypothesis. To that end, a grade of certainty can be assigned for the rules used for its construction. In that sense, a hypothesis built upon the usage of common sense generalization rules would have less probative value than an alternative hypothesis that also refers to standards proposed in international treaties.

The full probative weight requires hypotheses to outweigh a given threshold. Thus, an argument with full probative weight ensures that its inner elements of proof satisfy a minimum acceptable grade of confirmation, which means that it refers to an acceptable amount of support.

Both parameters of evaluation might be seen as a specific division of the weight parameter referred in Carneades. However, I believe such distinction is more appropriate in the context of the civil law where the sources of support form an heterogeneous mass, given that although case-based reasoning could be referred, it is not the main methodology: in addition we also consider general rules defined in different codes with grades of hierarchy deduced from constitutional provisions and international treaties, as well as other more subjective rules like common sense generalization and subsumption rules.

The usage of assumptions should also impact in the probative weight of the hypotheses. An assumption can be more or less credible, nevertheless whenever the assumption leads to coherent data integration of the case at hand, its credibility is enforced. In addition, the credibility would be higher when contrary hypotheses including an opposite assumption are defeated. An assumption can be additionally supported by an expert's report (*e.g.*, a psychological inform) required by the corresponding justice operator. In this case, the probative weight would be even higher.

Lucía's Revisited

Observe that the application of the proof standards for redefining defense conditions would imply a considerable change. Observe that while argument $\mathcal{A}_2$ defeats $\mathcal{A}_1$, the latter should have a much greater probative value given that it is constructed from high hierarchy legal codes whereas $\mathcal{A}_2$ has a much strong influence of common sense generalization rules. Also, the probative weight of $\mathcal{A}_2$ should not be full given that evidence is constructed from weak proof, making interpretations on whatsapp messages and testimonies of the accused. This means that $\mathcal{A}_2$ could not satisfy beyond the first standard of proof. For a criminal case, which is supposed to require the higher standard of proof, this would be unacceptable.

Nevertheless, the biased decision could be avoided by incorporating the interpretation corresponding to the precedent LNP. A recommender system would have prevented the construction of argument $\mathcal{A}_2$ given that the interpretation of whatsapp messages to answer about sexual antecedents of the victim would have triggered an inconsistency. That would have restored the defense of the hypothetical $\mathcal{A}_1$ based on the original assumption about absence of Lucía's consent.

On August of 2020 Casación (criminal appellate court) sentenced the nullity of the first instance's decision by ordering a new trial: *"The tribunal based its reasoning upon stereotypes and preconceptions from sex prejudices. They inferred sex consent from speculations on the personality and sexual past of the victim. Such are affirmations with absolute lack of factual support."*

Other Related Frameworks

Arguments in ASPIC+ [13] are built with both defeasible and strict inference rules. The latter allows to guarantee the argument's claim whereas the former only create a presumption in its favor. Similarly, the theory we propose handles hypotheses through assumptions, which can be understood as a way to rely upon defeasible assertions, and arguments relying upon evidence, which can be seen as strict or unquestionable assertions. Therefore, it is natural to have semantics assessing a different treatment to evidential arguments with respect to hypotheses.

Our approach is more similar to ABA (assumption-based argumentation) [14], [15], where no distinction is made for rules, since all of them are deductive. In ABA the defeasibility is determined through the use of assumptions for the construction of arguments. This is different from ASPIC+ where defeasibility relies directly on the usage of defeasible rules.

In our approach, we have different levels of defeasibility depending on the source from where the rule has been extracted. A highest level rule would be one corresponding to the constitutional hierarchy, whereas a *common sense generalization* (*CSG*) would be the lowest possible hierarchy of a rule, being more similar to a classical defeasible rule. However, defeasibility can be somehow “tricky” as *CSG* from different courts might correspond to different hierarchies.

ACKNOWLEDGMENT

Dr. Moguillansky thanks to *“Los Pollos de Russell”* research group and Prof. Juan Cumiz (UNS), for the many fruitful discussions on Lucía’s case and Ferrer Beltrán’s work.

REFERENCES

1. M. O. Moguillansky, A. Rotolo, and G. R. Simari, “Hypotheses and their dynamics in legal argumentation,” *Expert Syst. Appl.*, vol. 129, pp. 37–55, 2019. [Online]. Available: https://doi.org/10.1016/j.eswa.2019.03.047
2. H. Prakken and G. Sartor, “Law and logic: A review from an argumentation perspective,” *Artif. Intell.*, vol. 227, pp. 214–245, 2015. [Online]. Available: https://doi.org/10.1016/j.artint.2015.06.005
3. R. Guastini, *Estudios sobre la Interpretación Jurídica*. México DF., México: S.A. Editorial Porrua, 2003.
4. T. Bench-Capon, “The missing link revisited: The role of teleology in representing legal argument,” *Artif. Intell. Law*, vol. 10, no. 1-3, pp. 79–94, 2002.
5. D. Skalak and E. Rissland, “Arguments and cases: An inevitable intertwining,” *Artif. Intell. Law*, vol. 1, pp. 3–44, 1992.
6. J. Hage, *Reasoning with Rules: An Essay on Legal Reasoning and Its Underlying Logic*. Kluwer, 1997.
7. H. Hart, “Positivism and separation of law and morals,” *Harvard Law Review*, vol. 71, pp. 593–629, 02 1958.
8. T. Anderson, D. Schum, and W. Twining, *Analysis of Evidence*, ser. Law in Context. Cambridge, UK: Cambridge University Press, 2005.
9. A. M. Farley and K. Freeman, “Burden of Proof in Legal Argumentation,” in *Proceedings of the Fifth International Conference on Artificial Intelligence and Law, ICAIL ’95, College Park, Maryland, USA, May 21-24, 1995*, L. T. McCarty, Ed. ACM, 1995, pp. 156–164. [Online]. Available: https://doi.org/10.1145/222092.222227
10. T. F. Gordon and D. Walton, “The Carneades Argumentation Framework - Using Presumptions and Exceptions to Model Critical Questions,” in *Computational Models of Argument: Proceedings of COMMA 2006, September 11-12, 2006, Liverpool, UK*, ser. Frontiers in Artificial Intelligence and Applications, P. E. Dunne and T. J. M. Bench-Capon, Eds., vol. 144. IOS Press, 2006, pp. 195–207.
11. ——, “Proof Burdens and Standards,” in *Argumentation in Artificial Intelligence*, G. R. Simari and I. Rahwan, Eds. Springer, 2009, pp. 239–258.
12. J. F. Beltrán, “Prolegómenos para teoría sobre los estándares de prueba. El test case de la responsabilidad del Estado por prisión preventiva errónea,” in *Filosofa del derecho privado, Madrid (ESP), 2018*, D. Papayannis and E. Pereira, Eds. Marcial Pons, 2018, pp. 401–430.
13. S. Modgil and H. Prakken, “The *ASPIC*$^+$ framework for structured argumentation: a tutorial,” *Argument & Computation*, vol. 5, no. 1, pp. 31–62, 2014. [Online]. Available: https://doi.org/10.1080/19462166.2013.869766
14. A. Bondarenko, P. M. Dung, R. A. Kowalski, and F. Toni, “An abstract, argumentation-theoretic approach to default reasoning,” *Artif. Intell.*, vol. 93, pp. 63–101, 1997. [Online]. Available: https://doi.org/10.1016/S0004-3702(97)00015-5
15. P. M. Dung, R. A. Kowalski, and F. Toni, “Assumption-Based Argumentation,” in *Argumentation in Artificial Intelligence*, G. R. Simari and I. Rahwan, Eds. Springer, 2009, pp. 199–218. [Online]. Available: https://doi.org/10.1007/978-0-387-98197-0_10

Dr. Martín Moguillansky is an AI & Law researcher at ICIC-CONICET, head teaching assistant at UNS and director of JuriSIA (Socio-Juridical and AI research - https://icic.conicet.gov.ar/jurisia/) at ICIC – Universidad Nacional del Sur (UNS), Bahía Blanca, ARGENTINA. He received his PhD. in Computer Science at UNS (2011). Currently pursuing an M.Sc. in Legal Reasoning. Fulbrighter at University of Pittsburgh, US (2017) under the supervision of Kevin D. Ashley and Vern Walker. His research interests include formal argumentation and its application for contributing to the practice of legal reasoning.
Contact: mom@cs.uns.edu.ar