

# Evidence Types, Credibility Factors, and Patterns or Soft Rules for Weighing Conflicting Evidence: Argument Mining in the Context of Legal Rules Governing Evidence Assessment

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## Abstract

This paper reports on the results of an empirical study of adjudicatory decisions about veterans’ claims for disability benefits in the United States. It develops a typology of kinds of relevant evidence (argument premises) employed in cases, and it identifies factors that the tribunal considers when assessing the credibility or trustworthiness of individual items of evidence. It also reports on patterns or “soft rules” that the tribunal uses to comparatively weigh the probative value of conflicting evidence. These evidence types, credibility factors, and comparison patterns are developed to be inter-operable with legal rules governing the evidence assessment process in the U.S. This approach should be transferable to other legal and non-legal domains.

## Introduction: Systems Governed by Legal Rules

**Goal:** empirically derive a typology for arguments that:

- Is flexible enough to type most evidence assessment actually found in adjudicatory decisions;
- Is transferable to many substantive areas of law;
- Has a reasonable likelihood of automatic and accurate classification, so that software can identify trends and success rates with acceptably low error rates, and software can make recommendations about arguments in new cases; and
- Is inter-operable with the complex legal rules in the U.S. that constrain the evidence assessment process.

**Inter-operable with legal rules.** Adjudicatory processes in the United States are governed by complex legal rules.

**Substantive legal rules** establish the issues to be decided.

**Process legal rules** govern the procedures for deciding those issues, including any rules that constrain how evidence can be assessed. Legal rules have the logical form of conditionals: “if *p*, then *q*”. If an argument-mining system can identify and extract reasoning patterns using the same concepts as the legal rules, then it can check compliance with legal rules before recommending arguments in new legal cases.

## Dataset

Our study analyzed 30 fact-finding decisions issued by the U.S. Board of Veterans’ Appeals (“BVA”) from 2013 through 2016, which adjudicated disability claims by veterans for service-related post-traumatic stress disorder (PTSD). The BVA is an administrative appellate body that has the statutory authority to decide the facts of each case based on the evidence.

## Study Results: Evidence Types, Credibility / Trustworthiness Factors, and Conflict-Resolving Patterns

### Substantive Legal Rules (Establishing Issues to be Proved)

A veteran must prove that she has a disability that is “service-connected,” by proving three sub-issues of fact: (1) the veteran has a present disability (such as post-traumatic stress disorder, or PTSD); (2) while in active service, the veteran incurred an injury or disease, or the veteran suffered an aggravation of a pre-existing injury or disease, or there occurred an “in-service stressor” that is capable of causing PTSD; and (3) there is a causal relationship (or “nexus”) between the present disability and the in-service incurrence, aggravation, or stressor.

The veteran has a disability that is “service-connected.”  
&■ [1 of 3] The veteran has “a present disability.”  
V [1 of ...] The veteran has “a present disability” of posttraumatic stress disorder (PTSD), supported by “medical evidence diagnosing the condition in accordance with [38 C.F.R.] § 4.125(a).”  
V [2 of ...] ...  
&■ [2 of 3] The veteran incurred “a particular injury or disease ... consistent with service in the Armed Forces, or if preexisting such service, [it] was aggravated therein.”  
V [1 of ...] The veteran’s disability claim is for service connection of posttraumatic stress disorder (PTSD), and there is “credible supporting evidence that the claimed in-service stressor occurred.”  
V [2 of ...] ...  
&■ [3 of 3] There is “a causal relationship [“nexus”] between the present disability, and the disease or injury incurred or aggravated during service.”  
V [1 of ...] The veteran’s disability claim is for service connection of posttraumatic stress disorder (PTSD), and there is “a link, established by medical evidence, between current symptoms and an in-service stressor.”  
V [2 of ...] ...

### Sentence Types (Rhetorical Roles)

This study focused on sentences that play one of three reasoning roles in evidence assessment: a **finding of fact** (expressed by a “**finding sentence**”), which states whether a condition of a legal rule is determined to be true, false or undecided; the **evidence** (described in “**evidence sentences**”); and the **reasoning** from the evidence to the findings of fact (reported in “**reasoning sentences**”). The dataset contains 8,149 sentences, including (in the PTSD portions of the decisions) 310 finding sentences, 1,412 evidence sentences, and 442 reasoning sentences.

Semantic Type	Frequency
Sentence	8,149
Evidence Sentence	1,412
Reasoning Sentence	442
Finding Sentence	310

### Process Legal Rules (Governing Methods of Proof)

**Process rules** can dictate the relevance or irrelevance of certain types of evidence for particular conclusions, establish what some evidence presumptively proves, or determine when a set of evidence is minimally sufficient to warrant a reasonable inference.

Argument or Reasoning Pattern =  
Finding-of-Fact Sentence (Conclusion)  
Reasoning Sentences  
Evidence Sentences (Foundation)

### Types and Sub-Types of Evidence in the Sample of 30 BVA Decisions

Evidence Type	Evidence Sub-Type
Lay Testimony	Veteran
	Veteran’s spouse or partner
	Other veteran
	Other non-veteran
Medical Records	Pre-service
	In-service
	Post-service within the Veterans Administration
	Post-service not within Veterans Administration
Performance Evaluations	In-service
	Post-service
Other Service Records	
Other Expert Opinions	
Other Records	

### Patterns or Soft Rules for Weighing Conflicting Evidence

#### Factors Affecting Credibility of Lay Testimony

Aspects of Lay Testimony	Factors Affecting Credibility
Source of Testimony (Witness)	Demeanor of witness while testifying
	Character of witness
	Consistency of witness
	Bias, personal interest
Basis of Testimony	Degree of personal knowledge
	Awareness of other evidence
	Competence relative to content
Content of Testimony	Facial plausibility
	Consistency with other evidence
	Corroboration from other evidence

#### Factors Affecting Trustworthiness of Information within Medical Records

Aspects of Medical Records	Factors Affecting Trustworthiness
Source of Medical Record (author or source of content)	Relevant qualifications, expertise, etc.
	Bias, personal interest
	Personal observation of patient
	Credibility or accuracy of other information relied upon
Basis of Medical Record (e.g., physical examination, psychological evaluation)	Extent of patient’s record taken into account
Content of Medical Record	Remarks that undermine conclusiveness
	Extent of detail
	Consistency with other evidence
	Corroboration from other evidence

### Rules for Comparative Weighing of Conflicting Evidence

Over time, **patterns of reasoning** can develop for comparing the probative value of the conflicting evidence on a single issue of fact. Such patterns can become “**soft rules**”, when a reviewing court explicitly states that it is *reasonable* for the BVA to use such a pattern in its decisions. Examples in BVA decisions include:

- Assigning more probative value to the contents of a **medical record** than to **conflicting lay testimony** about the same topic, especially if the issue is diagnosis or etiology;
- Assigning more probative value to the contents of a **contemporaneous document** than to **conflicting testimony** made much later, especially if the testimony is discounted due to credibility factors; and
- Assigning the benefit of the doubt to the veteran when the conflicting evidence has **equal probative value**.

### Conclusions (Toward Argument Typing)

- 1) **Findings of fact** tend to rest upon **certain types of evidence**, primarily lay testimony and documentary evidence.
- 2) **Items of testimonial evidence** are often evaluated individually for their credibility, using a number of **credibility factors**.
- 3) **Items of documentary evidence** are often evaluated individually for their trustworthiness, using a number of **trustworthiness factors**.
- 4) **Comparatively weighing the conflicting evidence of the same type** (for or against a possible finding of fact) can use the **same factors** as for individual items of evidence.
- 5) **Comparatively weighing conflicting evidence of different types** may follow **patterns of reasoning or soft rules**.

### Resources

Annotated dataset on GitHub: [github.com/LLTLab/VetClaims](https://github.com/LLTLab/VetClaims).  
Research Laboratory for Law, Logic and Technology (LLT Lab): [www.LLTLab.org](http://www.LLTLab.org).

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