

# Sources and Facts Reliability Evaluation Method

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## 1 Introduction

There are numerous applications where an agent receives conflicting pieces of information from different sources. A standard way to solve this conflict is to believe the most trustable sources. We propose a method to evaluate the reliability from the past interactions. More exactly, we consider a set of agents (sources) that provide us information (facts) on different questions (objects). Our goal is to evaluate both the reliability of the sources, and the reliability of the facts, that then allow to find the correct answers for the different questions (objects). There are previous works that start from the same structure (sources/fact/objects), but their aim is only to find the correct answers ([1],[2]). As far as we know we propose the first approach that allow to identify the correct answers, but also to evaluate the reliability (truthfulness) of the sources.

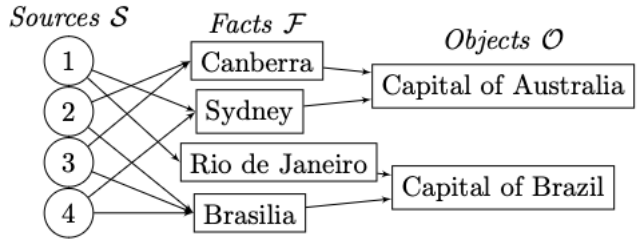
## 2 S&F Methods

In order to find the true information, we rely on the idea of Condorcet's Jury Theorem [3], which states that it is more likely that the majority of the individuals will choose the correct solution. In this work we suppose that initially we have no information on the reliability of the sources or on the truth among the facts. We define an iterative procedure to establish their reliability. At the beginning, all the sources have the same reliability, then we compare the answers to the different questions (objects), and we use this "Condorcet's Jury Theorem" argument for rewarding the sources that provide pieces of information (facts) that are confirmed by others, and then that are more likely true. The evaluation of the reliability of the sources is obtained by a vote from the objects. Each object will reward the sources that claim the most plausible facts and we will use scoring voting rules for computing this reliability. We wish to give the reliability of a source as the probability of this source to find the true facts. So, we have to normalize the reliability of the sources to obtain a frequency and to ensure that this reliability is between 0 and 1. Then we iterate the process with these adjusted reliability of the sources until convergence.

To illustrate this process, consider the example of figure 1b, where 4 sources give information on two objects : *Capital of Brazil* and *Capital of Australia*. Note that initially there is a tie for *Capital of Australia* : with 2 sources giving *Canberra* and 2 sources giving *Sydney*. But we can use the other object, when there is a majority for *Brasilia*. So *Brasilia* will be considered as the good fact, and the sources that give this fact will be favored w.r.t. the ones that give *Rio de Janeiro*. And, in the following iteration, we will be able to break the tie on *Capital of Australia* since more reliable sources give us *Camberra*.

	PIA	PIC	BordaA	BordaC
Best	✓	✓	✓	✓
Null Player	✓	✓	✓	✓
Groundedness[2]	✓	✓	✓	✓
Unanimity[2]	✓	✓	✓	✓
Neutrality[2]	✓	✓	✓	✓
Independence	✓	✓	✓	✓
Majority	✓	✓	✓	✓
Fact Coherence[2]	✓	✓	✓	✓
Claims	✓	✓	✓	✓
Best A	✓	✗	✓	✗
Best C	✗	✓	✗	✓
Worst	✓	✓	✗	✗
Source Dominance	✓	✗	✗	✗
Pareto	✗	✗	✓	✓
Source Coherence[2]	✗	✗	✗	✗
Monotonicity[2]	✗	✗	✗	✗
POI[2]	✗	✗	✗	✗

(a) Properties satisfied by S&amp;F methods



(b) Sources, Facts &amp; Objects

FIG. 1 – Properties and example

### 3 Properties

We propose a set of properties (see figure 1a) that *any* method should satisfy when this method aims to evaluate the reliability of sources and the confidence of facts. We also propose some additional interesting properties for characterizing subclasses of method and discuss properties proposed in [2]. The results are summarized in table 1a.

### 4 Experimental Study

Beside the theoretical evaluation, we also proceeded to an experimental evaluation of the performance of our methods. For the identification of the true facts, we compare our methods to algorithms from fact-finder literature [1, 2, 4, 5]. Our methods have similar, and often better results of methods from the literature in order to identify the true facts but our method also allow to correctly estimate the reliability of the sources.

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