Categorising Scientific Uncertainty in Papers

Iana Atanassova, François-C. Rey

Categorising Scientific Uncertainty in Papers

Iana Atanassova[1,2] and Francois-C. Rey[1]

[1] CRIT, Université de Bourgogne Franche-Comté, France

[2] Institut Universitaire de France (IUF)

iana.atanassova@univ-fcomte.fr,
francois_claude.rey@edu.univ-fcomte.fr

Why study uncertainty in science?

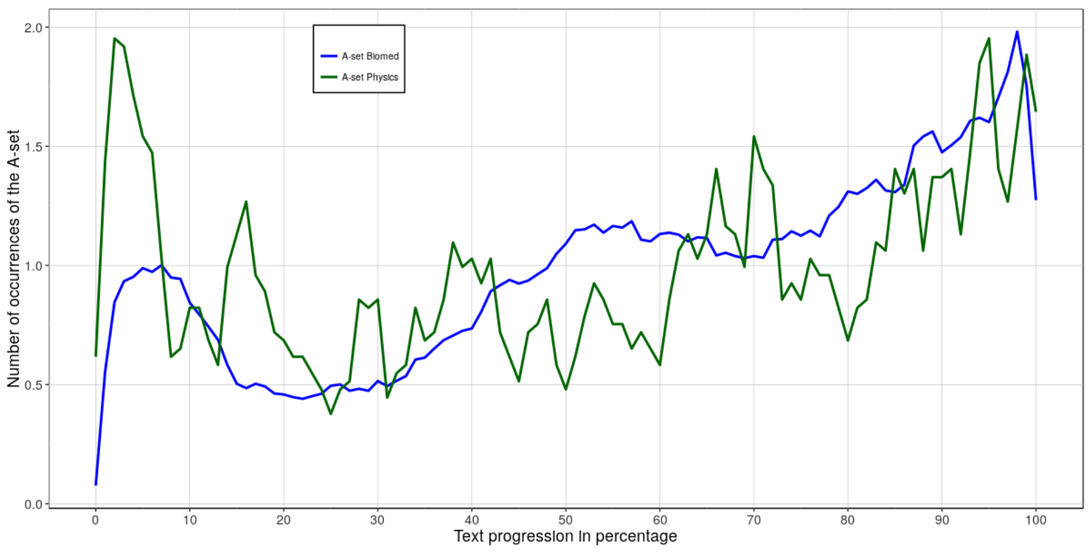
- Uncertainty in science is an integral part of the research process and an important element of discovery, and as such it is expressed in publications.
- The use of tools or observations produces a margin of error, and the use of abductive and inductive reasoning in science implies the presence of uncertainty.
- Uncertainty is specific to each discipline, linked to the object of the study, to the methodologies, or to the results.
- The expression of uncertainty in scientific articles makes use of complex linguistic properties.

Our objective is to study the expression of uncertainty in papers, in order to automatically identify and classify sentences that contain uncertainty.

Distribution of indicators of uncertainty [1]

We have processed two datasets of papers part of PubMed OA dataset: a Biomed dataset of 9 463 papers from 7 journals, and a Physics dataset of 488 papers from 2 journals.

A-set: strong indicators of uncertainty
raises (some) doubts about
there is no (clear) evidence of/about
more/further (...) studies/research/experiments /evaluation (are/is) needed to
may enforce the concept/theory/model of/about
it is plausible/possible/probable that
it is difficult/impossible to draw a (general) conclusion
we cannot be certain/sure that/if/whether
do/does not allow determining/identifying/measuring/evaluating ... with (absolute/greater) certainty
cannot be determined/identified/measured/evaluated ... with (absolute/greater) certainty
we cannot state/formulate/assess with (absolute/greater) certainty



Examples of sentences

Measurable uncertainty

"In the former Soviet Union the potential for increased carbon sequestration in agricultural soils is much greater, perhaps by an order of magnitude."

"This population of 250 individuals has a 50% chance of extinction over the next 100 years."

Qualitative uncertainty

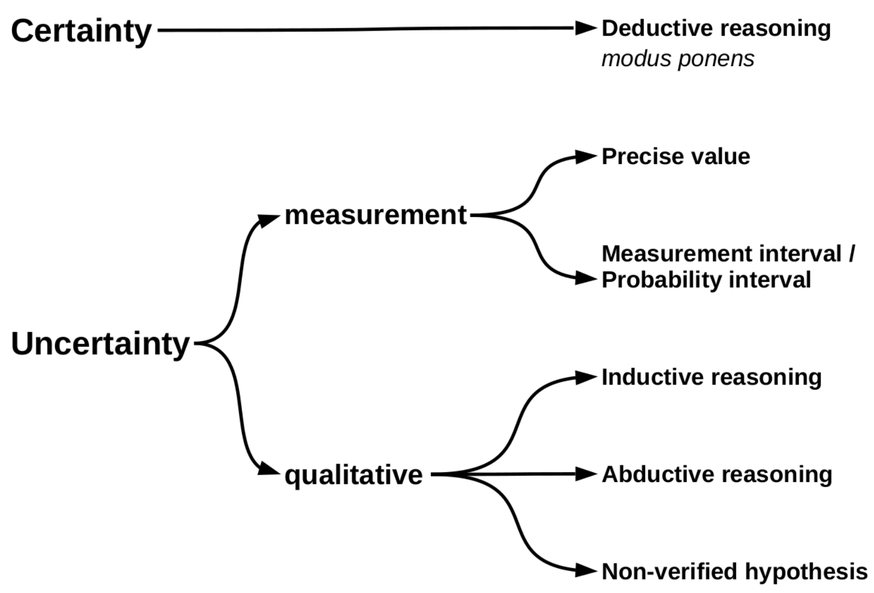
"It is not known what these root attributes may be."

"Secondly, the negative effect may be that temperature rise can increase the consumption of water and bring on a water deficit in some biomes."

"The greater discrepancy during the day may be due to solar heating of the metal screen in which the Ta /RH probe is housed."

Ontology of uncertainty [2]

- The creation of the ontology and the evaluation of the overall annotation scheme used a dataset of papers related to climate change retrieved from ISTEX.
- We have designed a formal grammar and linguistic rules to populate the ontology.
- These rules were used to produce, semi-automatically, a Gold Standard dataset of 700 annotated sentences.
- The evaluation of the rule-based annotation scheme obtained a Precision of 0.90.



References

[1] Iana Atanassova, François-C. Rey, and Marc Bertin. Studying Uncertainty in Science: a distributional analysis through the IMRaD structure. *Conférence 7th International Workshop On Mining Scientific Publications (WOSP) - LREC, 7-12 May 2018, Miyazaki, Japan*, 2018.

[2] François-C. Rey, Marc Bertin, and Iana Atanassova. Une étude de l'incertitude dans les textes scientifiques : vers la construction d'une ontologie. *Terminologie & Ontologie : Théories et Applications (TOTh), Chambéry, France*, 2018.

Acknowledgements

Part of this research has been funded by the ANR-JCJC Project InSciM - "Modelling Uncertainty in Science".

SciNLP 2021 - 8 October 2021
2nd Workshop on Natural Language Processing for Scientific Text