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Note on Partial Falsifiability of Fuzzy and Fuzzy-Extension Hypotheses

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Abstract

In this short note we adjust the (classical) Falsifiability of a hypothesis that may be 100% true as in classical logic, to the field of multi-valued logics, where there are partialities of truth-value, of indeterminacy, and of false-value of a hypothesis, and we call it Partial Falsifiability.

Keywords: Partial Falsifiability, Fuzzy-Extension Hypotheses, Classical Falsifiability.

1 | Falsifiability

A (classical, i.e. non multi-valued) hypothesis is considered credible when it is falsifiable (or refutable), meaning there is a possibility it could be proven inconsistent. Falsifiability, a concept introduced by Austrian philosopher of science Karl Popper (1902-1994), asserts that a theory must be falsifiable to be classified as scientific.

Karl Popper's concept of falsification [1] argues that the purpose of scientific inquiry is not to validate hypotheses, but rather to rigorously examine them and determine under what conditions they can be proven false. According to the falsification principle, a valid scientific theory must generate hypotheses that can potentially be disproven by empirical evidence or experimental outcomes. In contrast to verification, which seeks to affirm theoretical predictions, falsification is about decisively disproving them.

In scientific methodology, testability and replicability are widely accepted principles. However, the idea of falsifiability has been met with varying levels of acceptance.

Abstract and precise mathematical and scientific statements are not inherently falsifiable, as noted by Carnap in 1937. For example, if a theory is proven false, it is generally discarded.

2 | Partial Falsibiality

But what about multi-valued logical hypotheses, which allow for partial degrees of truth, indeterminacy, and falsehood, as for example, in neutrosophic logic? How do we test and make such hypotheses falsifiable with these kinds of complexities?

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Until now, hypotheses have been considered classical (i.e., propositions that were 100% true or nearly so), but now we are extending this to hypotheses represented by propositions from multi-valued logic.

(i) Logical interpretation

If a neutrosophic logic hypothesis $\mathrm{NLH}(t, i, f)$ is falsifiable, where $t, i, f \in [0, 1]$ are degress of truth, indeterminacy, and falsehood respectively, then there should exist some space, time, and conditions within which the above neutrosophic hypothesis is negated, getting $\neg\mathrm{NLH}(f, 1 - i, t)$.

(ii) Probability interpretation

Let $\mathrm{NPH}(t, i, f)$ be a neutrosophic probabilistic hypothesis, where $t, i, f \in [0, 1]$ represent the chance that this hypothesis occurs, indeterminate-chance that the hypothesis occurs or not, and the chance that the hypothesis does not occur, respectively.

$\mathrm{NPH}(t, i, f,)$ is falsifiable if, similarly, there exist some space, time, and conditions under which the NPH is negated, getting: $\neg\mathrm{NPH}(f, 1 - i, t)$.

3 | Conclusion

In this short note we made a distinction between classical logical hypotheses and multi-valued logical hypotheses, and we introduced the concept of Partial Falsifiability as adaptation of the Popper's Falsifiability from classical logic to the multi-valued logics. We only used the neutrosophic logic, but any fuzzy and fuzzy extension logics [2] could be used, resulting in the same partiality of the falsifiability.

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Data Availability

The datasets generated during and/or analyzed during the current study are not publicly available due to the privacy-preserving nature of the data but are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that there is no conflict of interest in the research.

Ethical Approval

This article does not contain any studies with human participants or animals performed by any of the authors.

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[2] Florentin Smarandache, Neutrosophic Set is a Generalization of Intuitionistic Fuzzy Set, Inconsistent Intuitionistic Fuzzy Set (Picture Fuzzy Set, Ternary Fuzzy Set), Pythagorean Fuzzy Set (Atanassov's Intuitionistic Fuzzy Set of second type), q-Rung Orthopair Fuzzy Set, Spherical Fuzzy Set, and n-HyperSpherical Fuzzy Set, while Neutrosophication is a Generalization of Regret Theory, Grey System Theory, and Three-Ways Decision (revisited), Journal of New Theory 29 (2019) 01-35; arXiv, Cornell University, New York City, NY, USA, pp. 1-50, 17-29 November 2019, https://arxiv.org/ftp/arxiv/papers/1911/1911.07333.pdf; University of New Mexico, Albuquerque, USA, Digital Repository, pp. 1-50, https://digitalrepository.unm.edu/math_fsp/21.