

Machine Learning as a Tool for Hypothesis Generation

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1 Research questions

How do ML algorithms generate novel and interpret-able hypothesis about human behavior?

2 Why are the research questions interesting?

- Science is curiously asymmetric, and researchers face a challenge in uncovering new hypos.
 - Traditional hypos generation is informal and relies heavily on the intuition and expertise of researchers.
- Two developments:
 - ML tools analyze large datasets to detect patterns that analysts may not discover.
 - Explosive growth of data: machine readable: mental data is increasingly becoming actual data.

3 What is the paper's contribution?

(1) Literature on generating hypothesis: ML generating unexpected findings

Exploring investigator-generated hypos; Integrating ML into the way science is conducted.

Previous: Deep learning algorithm is better at predicting patient pain from an X-ray than clinicians do.

- Examining whether physicians suffer from limited attention when diagnosing patients.

This paper: Introducing a systematic procedure for generating hypos using ML algorithms.(A more structured and data-driven approach to identify novel hypos)

4 What hypotheses are tested in the paper?

H1: ML algorithms generate hypotheses that are both novel and testable.

a) Do these hypotheses follow from and answer the research questions?

- Author primarily focuses on ML for generating hypos rather than testing specific empirical hypotheses.

Do these hypotheses follow from theory or are they otherwise adequately developed?

- Empirical analysis highlights the potential for ML to uncover hidden patterns and biases in judicial behavior.
- The result serves as a proof of concept for the broader argument that ML can be a powerful tool for generating hypos and insights in social science research.

5 Sample: comment on the appropriateness of sample selection procedures.

The appropriateness of the sample selection procedures in the paper hinges on ensuring the sample is representative of the broader population, sufficiently large, randomly selected to avoid bias, and ethically sourced.

6 Dependent and independent variables: comment on the appropriateness.

The dv (judicial decision) is appropriate given its relevance and potential for generating new insights.

The indv, particularly the mugshots, are innovative but must be handled with care to ensure interpretability.

7 Regression model specification: comment on the appropriateness.

Regression is appropriate given its alignment with the objective of hypothesis generation and interpretability. However, its effectiveness depends on proper data preprocessing, validation, and ethical considerations.

8 What difficulties arise in drawing inferences from the empirical work?

The reliability of the inferences drawn depends heavily on the quality and representativeness of the data used. Biases in the data, such as sampling bias, leads to misleading patterns and erroneous hypos.

9 Describe at least one publishable and feasible extension of this research.

Future research can explore other aspects of the criminal justice system, such as parole decisions, sentencing differences, or recidivism patterns, and for economic fields as well.

References

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- [2] Sunstein, Cass R., "Governing by Algorithm? No Noise and (Potentially) Less Bias," *Duke Law Journal*, 71 (2021), 1175–1205. <https://doi.org/10.2139/ssrn.3925240>