Selective Regression Under Fairness Criteria

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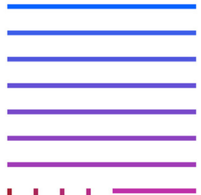

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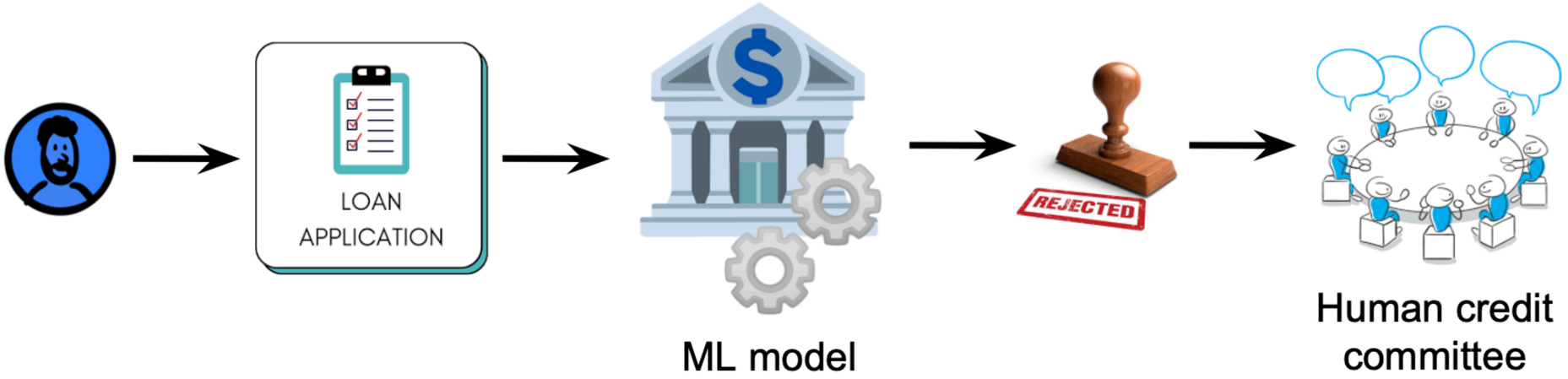
Selective Prediction

Prediction with a reject-option

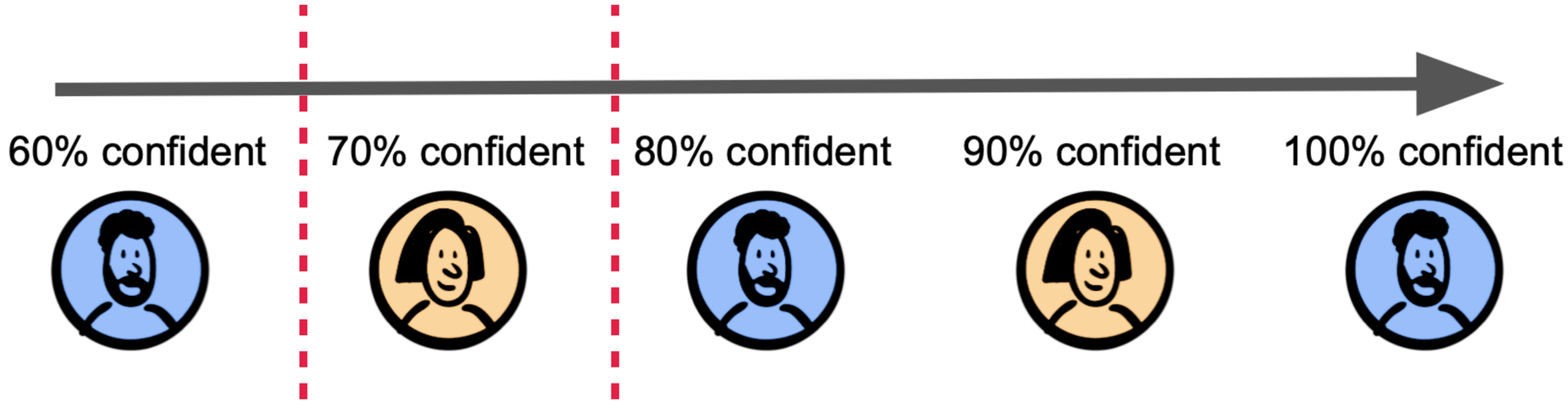
- A trustworthy machine learning system → reliably communicate the uncertainty in its predictions.
- If the uncertainty in a prediction is high → the prediction can be rejected to avoid potentially costly errors.
- Selective prediction → can abstain from making a decision



Selective Prediction

Prediction with reject-option

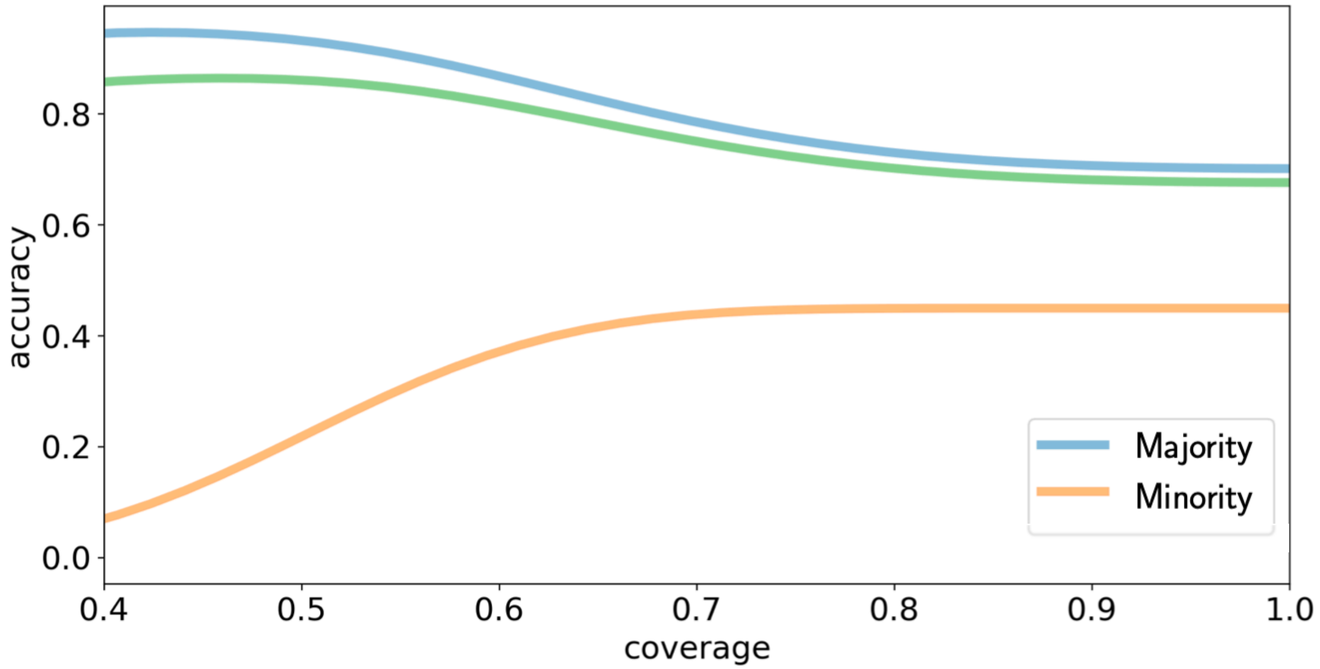
- If we have confidence measure for each prediction → abstain from decision making if our confidence is below a certain threshold.
- With a good confidence measure → increasing the threshold results in a better performance.
- Tradeoff → we have predictions for a fewer samples (i.e., low coverage).



Selective Classification

Prior Work

- Classifiers can have good average performance but may perform poorly on certain protected / sensitive groups [Jones et al. 2020].



- To mitigate such disparities, recent works [Lee et al., 2021; Schreuder & Chzhen, 2021] proposed methods for performing fair selective classification.

Selective Regression

Designing an Uncertainty measure

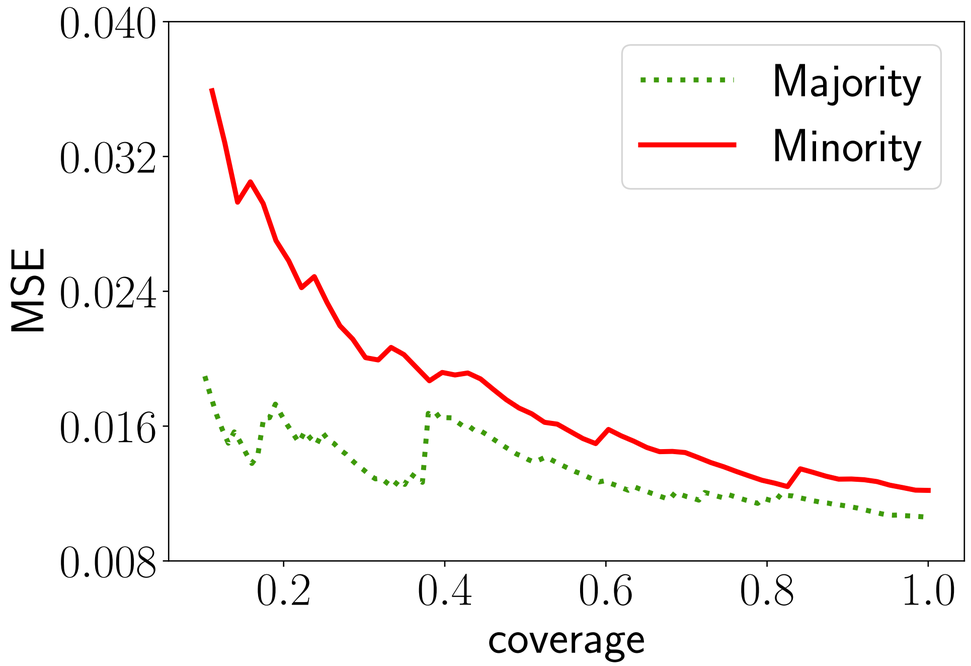
Classification → learned using the softmax output (of an existing classifier)

Regression → no direct method to learn from an existing regressor designed only to predict the conditional mean

Biases in Selective Regression

Contributions

- We show that selective regression, like selective classification, can decrease the performance of some protected groups when coverage is reduced.



Insurance dataset

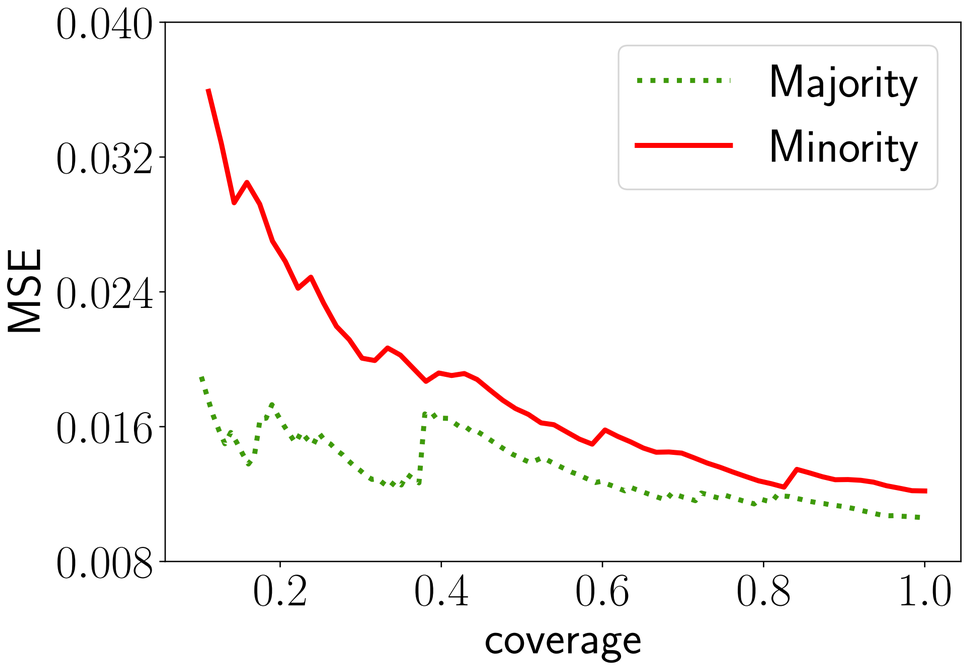
Fair Selective Regression

Contributions

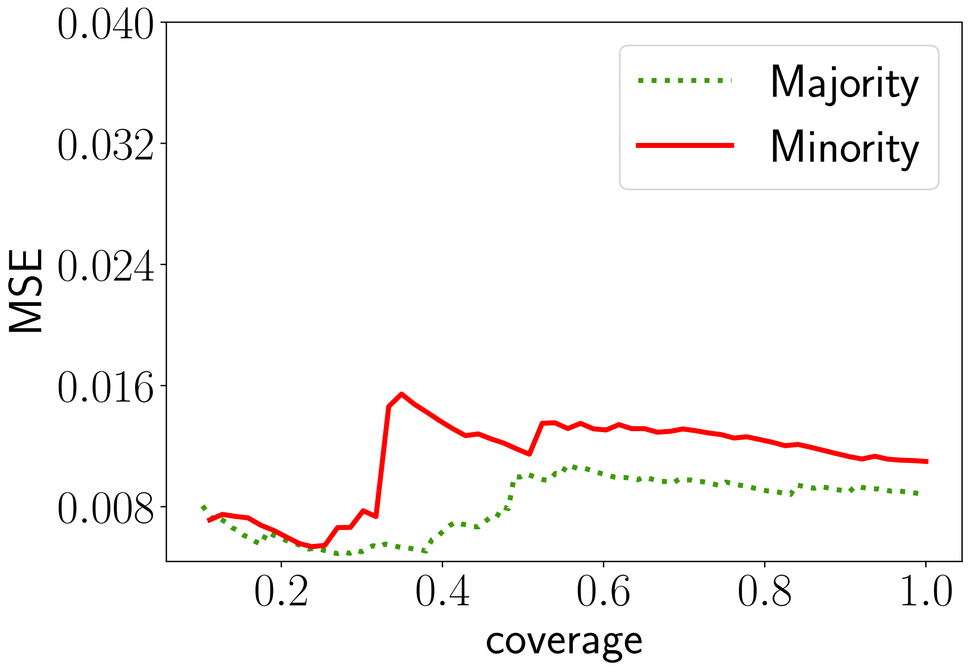
- Monotonic selective risk → requires the risk (i.e., MSE) of each subgroup to monotonically decrease with a decrease in coverage.
- Monotonic selective risk is met if a feature representation:
    1. satisfies the standard sufficiency criterion or
    2. is calibrated for mean and variance.
- Two algorithms:
    1. impose the sufficiency criterion by regularizing an upper bound of conditional mutual information.
    2. impose the calibration for mean and variance by regularizing a contrastive loss.

Empirical Results

Insurance dataset



Baseline



Our method

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