Bachelor’s Thesis

Benchmarking conformal prediction methods
For time series regression

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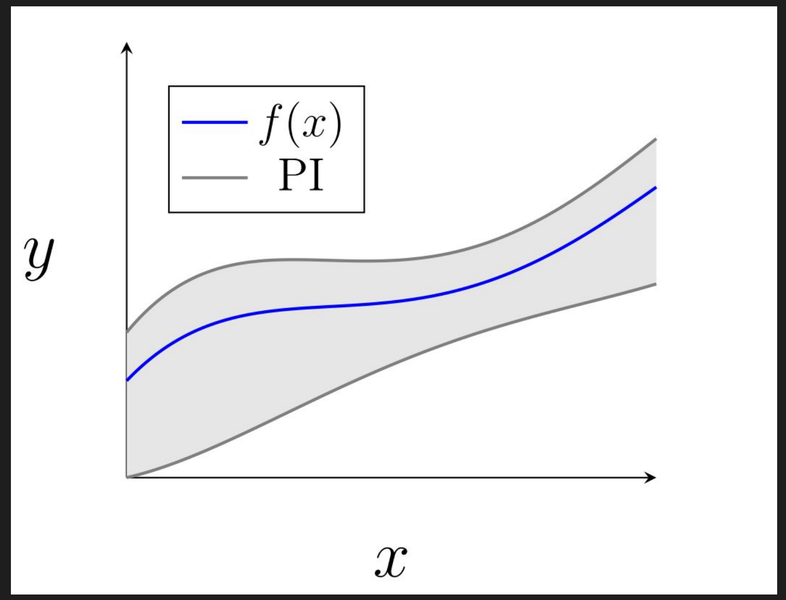
Conformal Prediction

Uncertainty Quantification



High-risk settings

Distribution-free

Theoretical guarantee: marginal coverage

$$\mathbb{P}(Y_{\text{test}} \in \mathcal{C}(X_{\text{test}})) \geq 1 - \alpha$$

Ground truth value

Prediction interval

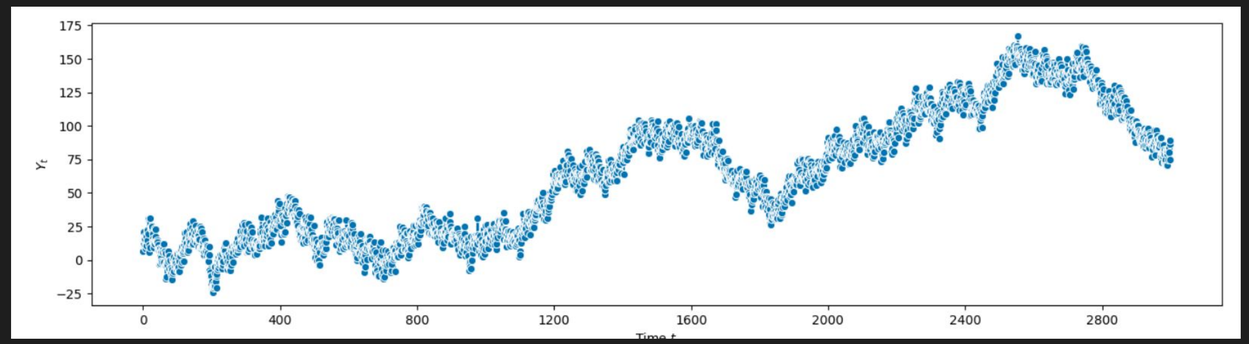
Miscoverage rate

Challenge: Time Series

Conformal prediction is built on an assumption: *exchangeability*

$$P(x1, x2, x3) = P(x3, x1, x2)$$

Distribution shift → assumption does not hold!

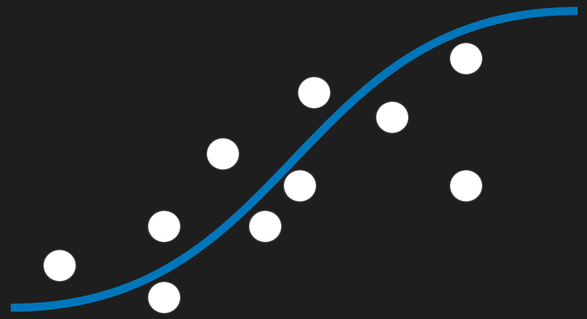


Adaptive methods!

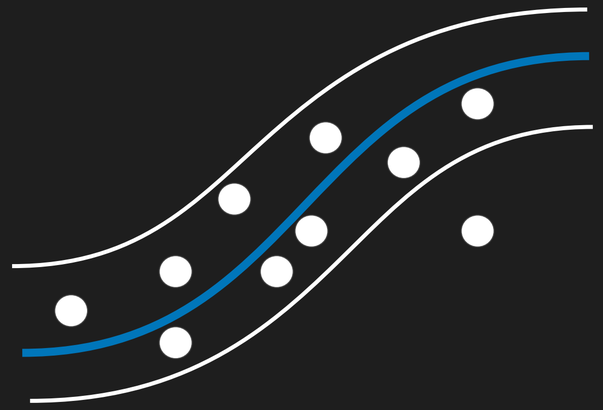
Solution?

My thesis

Regressors

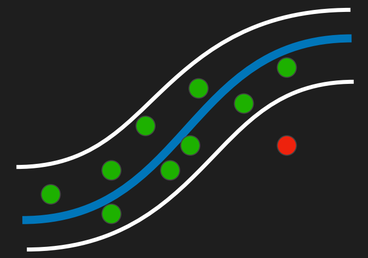


Conformal methods

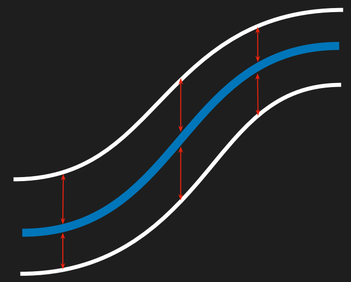


Evaluation

Empirical coverage



Prediction interval width



AI Safety

We need safer AI.

Uncertainty quantification is only a small piece of the puzzle.

For AI Safety there is more to do:

- *Model robustness* for adversarial attacks
- Transparency and *mechanistic interpretability*
- *Scalable oversight* to guide AI behaviour
- International standards, monitoring and regulation