R-LIME: Rectangular Constraints and Optimization for Local Interpretable Model-agnostic Explanation Methods

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Background

Interpretable Machine Learning

- Simple ML models (White-box)
  - Linear Models
  - Decision Trees

→ Decision process is clear

- Complex ML models (Black-box)
  - Deep Neural Networks
  - Ensemble Models

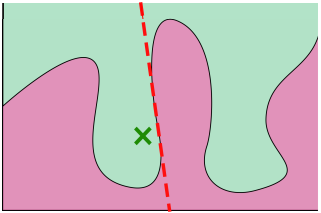
→ Decision process is unclear

Approximate Locally

Related Work: LIME & Anchor

LIME

- Approximate the model locally based on the perturbed samples

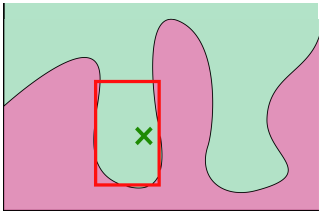


Visual illustration of LIME.

But how general is this explanation?

Anchor

- Maximize the rectangular region as long as the model's outputs are mostly consistent.



Visual illustration of Anchor.

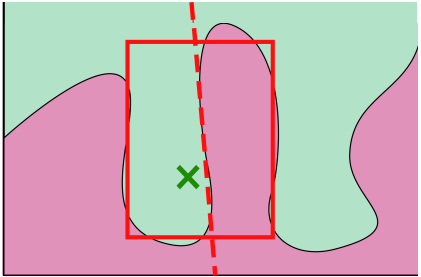
But how much influence does each feature have?

Proposed Method: R-LIME

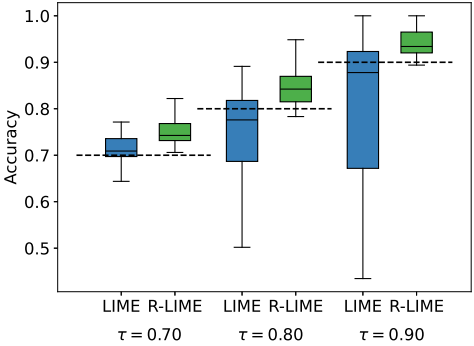
R-LIME (Ruled LIME) = LIME + Anchor

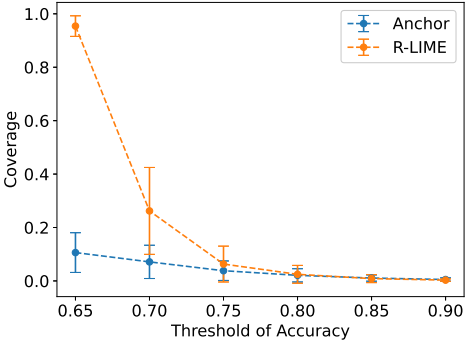
- Approximate in rectangular region
- Maximize the rectangular region as long as the approximation is accurate.
- Express the region as a conjunction of feature predicates

  ex. $\text{Gender} = \text{'Male'}$ AND $20 \leq \text{Age} < 30$



Experiments





- Much higher accuracy of R-LIME than LIME, especially for large τ
- Much higher coverage of R-LIME than Anchor, especially for small τ

Conclusion

	LIME	Anchor	**R-LIME**
Feature Importance	✓	×	✓
Optimal Scope	×	✓	✓
Interpretable Scope	×	✓	✓

Our methods achieves interpretability of both explanation and its scope!

Also:

- More accurate than LIME
- More general than Anchor