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Faithful Perturbations and Evaluations for Post-Hoc Local Explanation Methods

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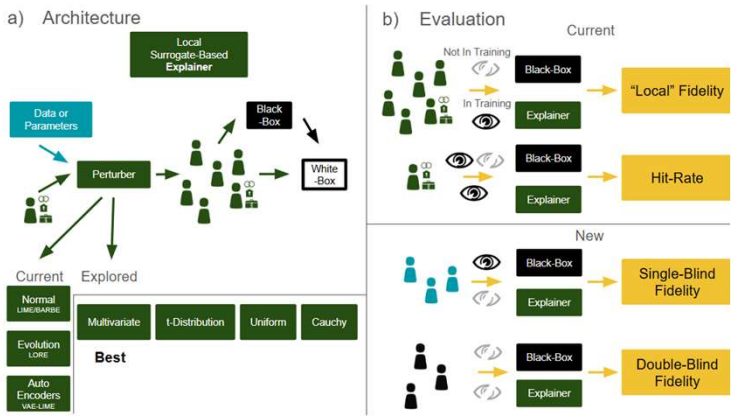
Post-Hoc **Explainers**

- Explain a **pre-trained black-box**
- **No access to original training data** is guaranteed
- Only get a **label from the black-box**

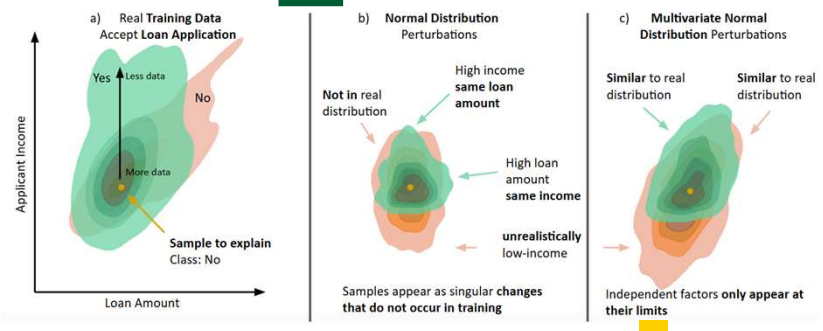


Perturbation

- **Produce data** using a strategy or distribution **labeled by black-box**
- **Other methods** require access to data
- Other methods prefer **probability outputs as labels to learn on**

Evaluation

- **Accuracy of the representation** the surrogate has to the **local black-box decision making**
- **Major flaw** is some methods use perturbed data for evaluation
  - Distribution may be **better known by explainer**
  - **No guarantee** it represents realistic local samples



Data	Eval.	LIME+P	BARBE+P	LIME	BARBE	LORE	VAE-LIME
Iris	Pert. Fid.	0.87 ± 0.06	0.84 ± 0.07	0.87 ± 0.04	0.83 ± 0.03	**0.99**±0.01	0.97 ± 0.06
	SB Fid.	**0.83**†±0.10	0.73 ± 0.14	0.76 ± 0.16	**0.78**±0.14	0.73 ± 0.15	0.58 ± 0.19
	DB Fid.	**0.79**†±0.17	0.69 ± 0.16	0.74 ± 0.16	**0.74**±0.19	0.72 ± 0.16	0.49 ± 0.20
	Hit Rate	0.65	**1**	0.633	**1**	**1**	0.533
BC	Pert. Fid.	0.92 ± 0.05	**0.99**±0.01	0.86 ± 0.07	0.99 ± 0.02	0.98 ± 0.02	0.97 ± 0.02
	SB Fid.	**0.92***±0.08	**0.89**±0.08	0.60 ± 0.27	0.67 ± 0.20	0.74 ± 0.17	0.87 ± 0.09
	DB Fid.	**0.93***±0.09	**0.89**±0.01	0.60 ± 0.27	0.67 ± 0.20	0.74 ± 0.17	0.86 ± 0.11
	Hit Rate	0.7	**1**	0.72	**1**	**1**	0.61
Loan	Pert. Fid.	0.72 ± 0.05	0.87 ± 0.04	0.73 ± 0.05	0.83 ± 0.04	**0.97**±0.08	0.85 ± 0.06
	SB Fid.	0.61 ± 0.20	**0.81**±0.10	0.64 ± 0.19	0.76 ± 0.19	0.78 ± 0.07	0.76 ± 0.11
	DB Fid.	0.65 ± 0.23	**0.81**±0.13	0.68 ± 0.20	0.76 ± 0.20	0.79 ± 0.16	0.80† ± 0.13
	Hit Rate	0.68	0.98	0.69	0.94	0.95	0.64
Libras	Pert. Fid.	0.58 ± 0.09	0.79 ± 0.04	0.70 ± 0.11	**0.99**±0.00	0.93 ± 0.02	0.84 ± 0.09
	l-SB Fid.	**0.48**†±0.22	**0.43**±0.16	0.38 ± 0.18	0.23 ± 0.11	0.41 ± 0.19	0.39 ± 0.20
	l-DB Fid.	**0.48**†±0.30	**0.42**±0.22	0.29 ± 0.06	0.18 ± 0.15	0.42 ± 0.24	**0.47**†±0.24
	Hit Rate	0.5	**1**	0.417	**1**	0.8	0.417
Avg.	Pert. Fid.	0.773	0.873	0.790	0.910	**0.968**	0.908
	l-SB Fid.	0.710	**0.715**	0.595	0.610	0.665	0.650
	l-DB Fid.	**0.713**†	**0.703**	0.578	0.588	0.668	0.655
	Hit Rate	0.633	**0.995**	0.615	0.985	0.938	0.550

Our Changes

- **Perturbation:** use multivariate distributions for **correlated features**
- **Evaluation:** fidelity on **real data** weighted by distance to the perturbed sample

Results

- Averaged results using a **Random Forest and Neural Network** black-box
- Tested on **six variation of explainer**
  - **Two with our perturbations**

- Found that fidelity on **perturbed data is not the same as on real data**
- Found that **changes improved LIME**
- Even greater **improvements on other methods like BARBE**