LIME - Local Interpretable Model-agnostic Explanations

Tulio Ribeiro, Marco & Singh, Sameer & Guestrin, Carlos. (2016).
“Why Should I Trust You?”: Explaining the Predictions of Any Classifier. 97-101. 10.18653/v1/N16-3020.

Predicted: wolf
True: wolf

Predicted: husky
True: husky

Predicted: wolf
True: wolf

Tylko 1 błąd!

Predicted: wolf
True: husky

Predicted: husky
True: husky

Predicted: wolf
True: wolf

Predicted: wolf
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Predicted: husky
True: husky

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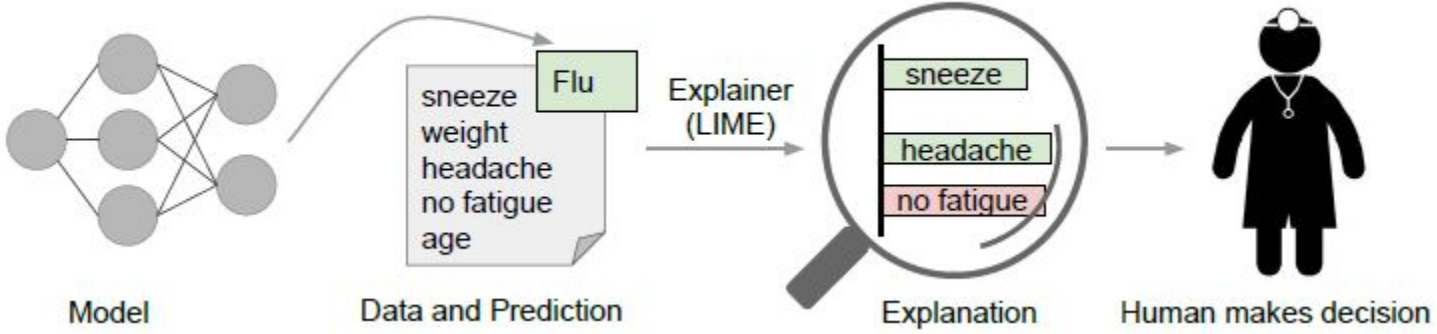
True: wolf

Predicted: wolf
True: husky

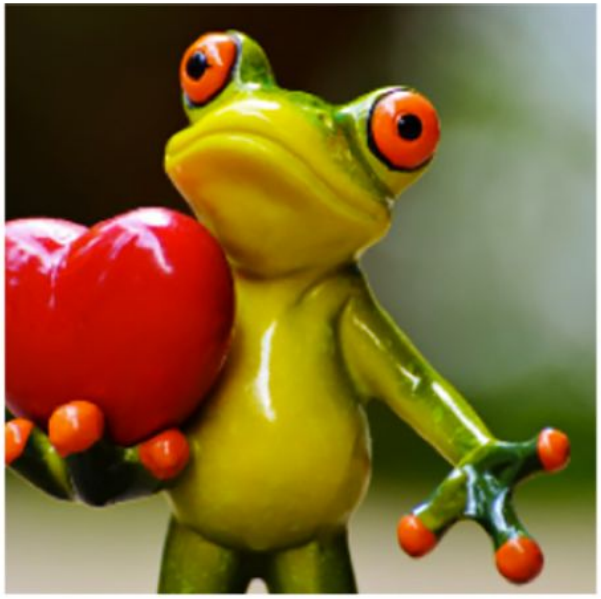
Predicted: husky
True: husky

Predicted: wolf
True: wolf

Wyjaśnianie pojedynczej predykcji



Jak działa LIME? - przypadek szczególny

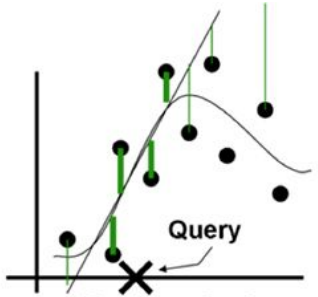


Original Image

Interpretable Components

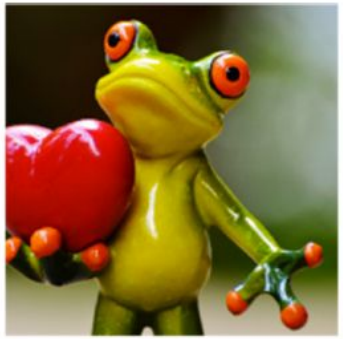
Original Image
P(tree frog) = 0.54

Perturbed Instances	P(tree frog)
	0.85
	0.00001
	0.52



Locally weighted regression

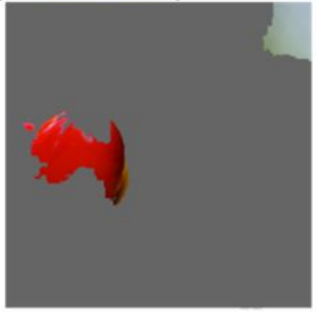
Explanation



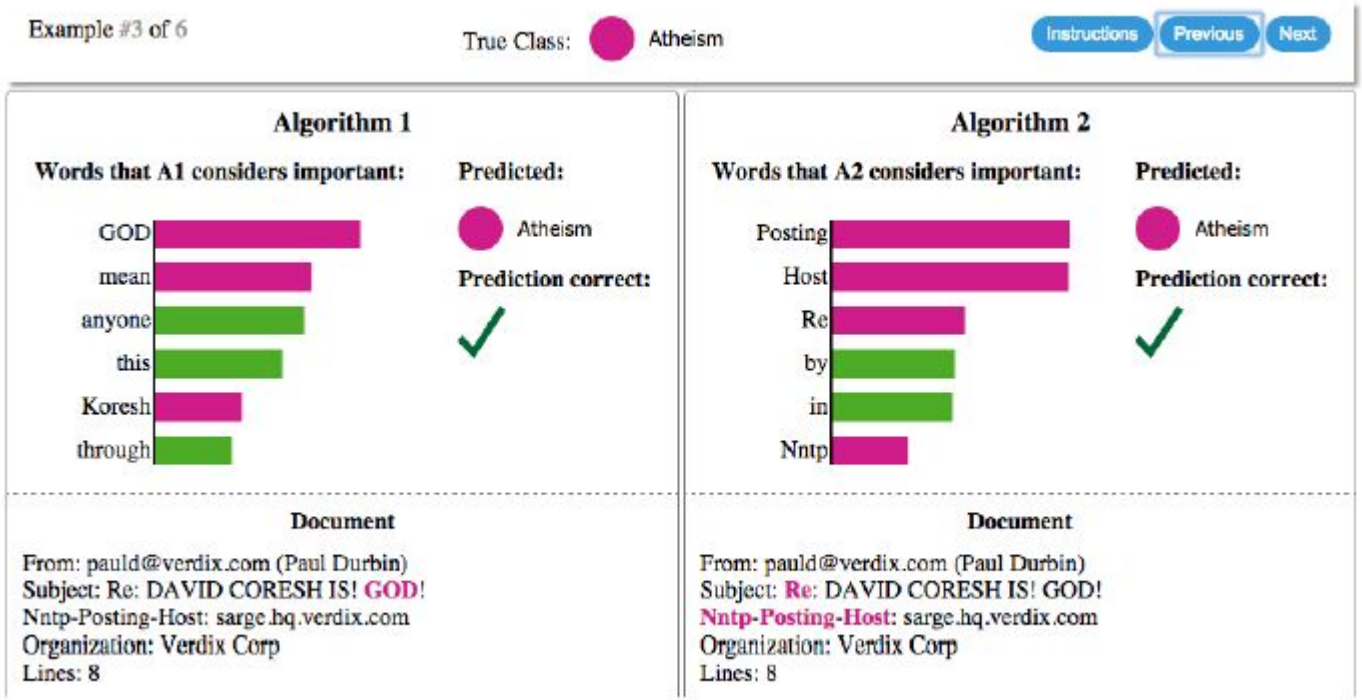
P() = 0.54

P() = 0.07

P() = 0.05



Który model wybrać?



Pożądane własności

interpretowalność

lokalna wierność

niezależność od modelu

A można matematycznie?

$x \in \mathbb{R}^d$ - oryginalna reprezentacja rozpatrywanego przypadku (obserwacji)

$x' \in 0, 1^{d'}$ - wektor binarny, interpretowalna reprezentcaja x

$g \in G$ - wyjaśniający model z klasy potencjalnie interpretowalnych modeli, np modele liniowe, drzewa, ...

$\Omega(g)$ - miara złożoności modelu

$f : \mathbb{R}^d \to \mathbb{R}$ - model wyjaśniany

$\pi_x(z)$ - miara odległości obserwacji z od x

$\mathcal{L}(f, g, \pi_x)$ - miara wiarygodności modelu g w przybliżaniu modelu f.

$$\xi(x) = \underset{g \in G}{\operatorname{argmin}} \mathcal{L}(f, g, \pi_x) + \Omega(g)$$

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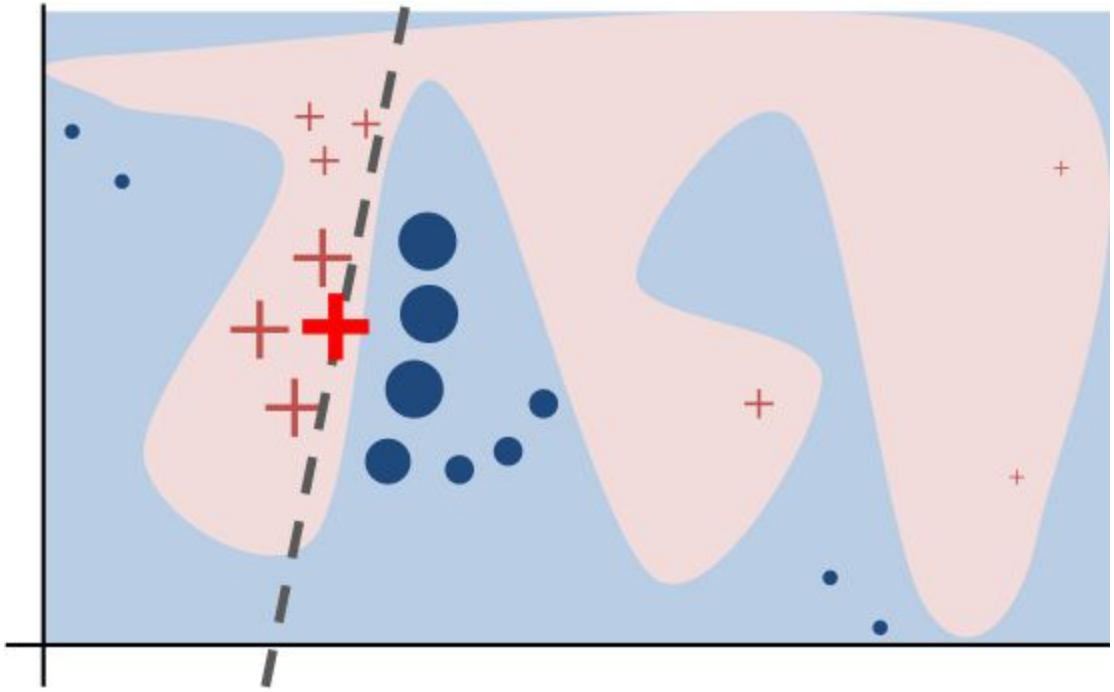
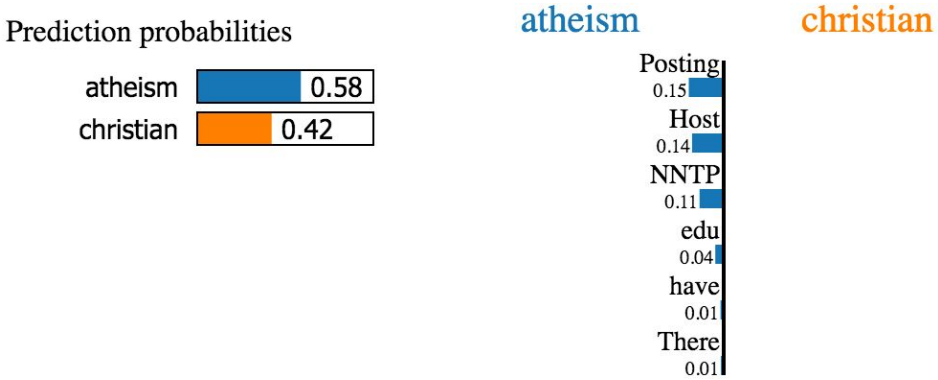
Dopasowanie lokalnego modelu



Lokalne wyjaśnienie modelu



R - use case

```
> library(lime)
> explainer <- lime(sentence_to_explain, model = xgb_model, preprocess = get_matrix)
> explanation <- explain(sentence_to_explain, explainer, n_labels = 1, n_features = 2)
```

R - use case

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> library(lime)
> explainer <- lime(sentence_to_explain, model = xgb_model, preprocess = get_matrix)
> explanation <- explain(sentence_to_explain, explainer, n_labels = 1, n_features = 2)
> explanation[, 2:9]
         case label label_prob  model_r2 model_intercept model_prediction  feature feature_value
in          1     1  0.6418385 0.9881959       0.3323441        0.6436369       in            in
we          1     1  0.6418385 0.9881959       0.3323441        0.6436369       we            we
in1         2     1  0.8022363 0.8535779       0.3223901        0.7353984       in            in
We          2     1  0.8022363 0.8535779       0.3223901        0.7353984       We            We
those       3     0  0.5432571 0.8854101       0.6918100        0.4974141    those         those
we1         3     0  0.5432571 0.8854101       0.6918100        0.4974141       we            we
in2         4     1  0.8719526 0.6674597       0.4926221        0.8397768       in            in
Section     4     1  0.8719526 0.6674597       0.4926221        0.8397768  Section       Section
CITATION    5     1  0.7316587 0.4420266       0.4437610        0.6119218 CITATION      CITATION
our         5     1  0.7316587 0.4420266       0.4437610        0.6119218      our           our
```


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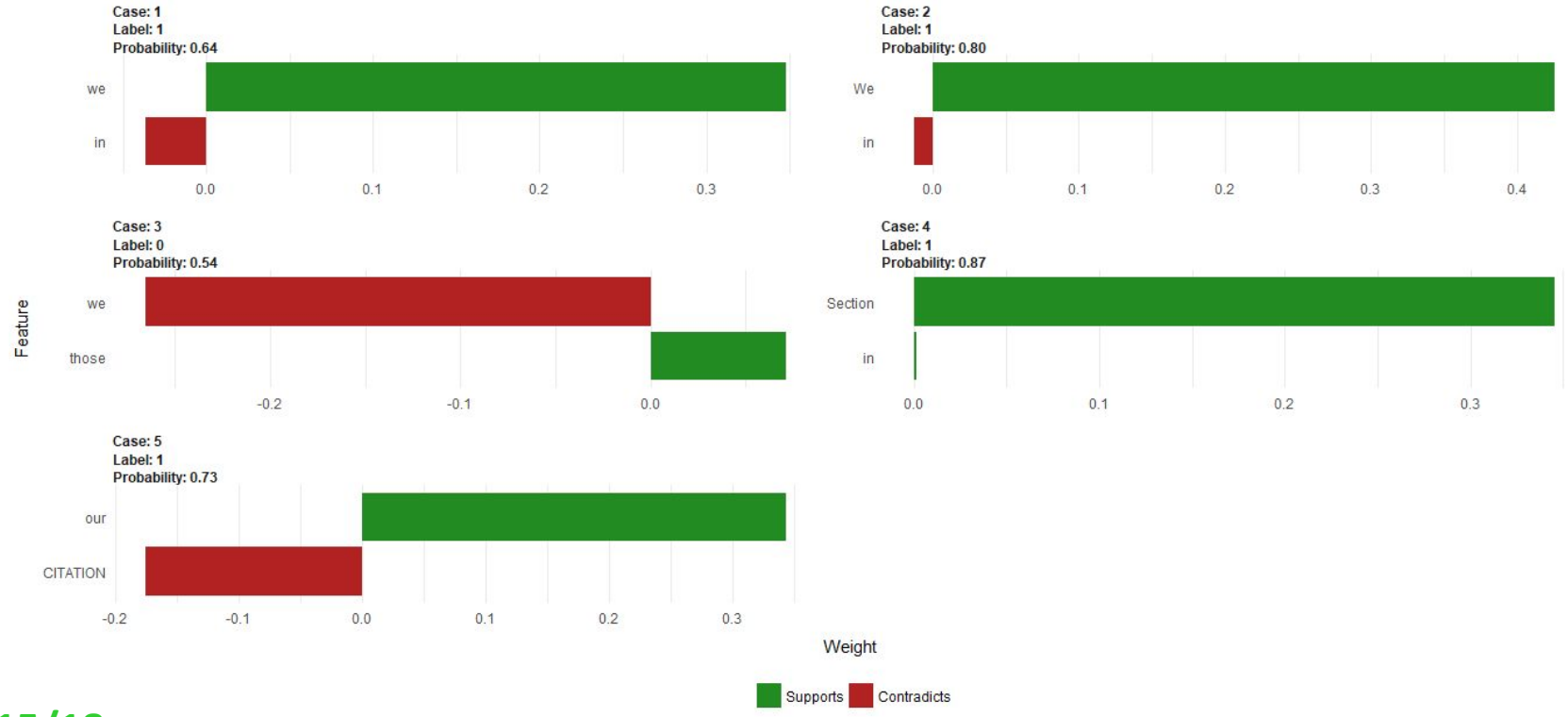
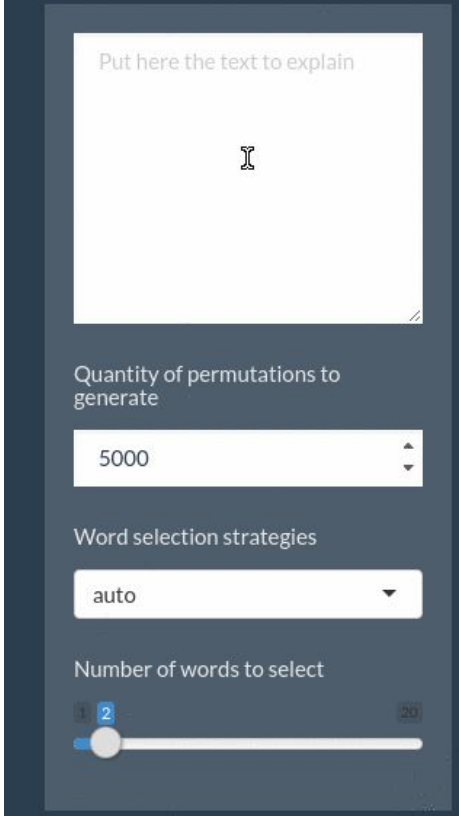
R - use case

```
> plot_features(explanation)
```



Local Interpretable Model-agnostic Explanations



Text provided is too short to be explained (>= 3).

There once was a package called lime,
Whose models were simply sublime,
It gave explanations for their variations,
one observation at a time.

lime-rick by Mara Averick

Kilka źródeł na koniec

https://arxiv.org/abs/1602.04938

https://cran.r-project.org/web/packages/lime/vignettes/Understanding_lime.html

https://www.slideshare.net/0xdata/explaining-blackbox-machine-learning-predictions

https://www.youtube.com/watch?v=KP7-JtFMLo4

https://www.oreilly.com/learning/introduction-to-local-interpretable-model-agnostic-explanations-lime

https://github.com/marcotcr/lime

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