Classifier Explanation

Introduction to the Algorithms LIME and SP-LIME

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Trusting a Prediction

Intro

Me: Hey Siri, order me a Pizza

Siri: *(After a short break that nearly drains your whole battery)* Ok, I'm calling your mother...

Me: Wait! Why would you do this!?

Siri: This is the 5th time you ordered Pizza this week.

Trusting a Prediction

Goals

What do we want from our model?

1. Why did failed predictions fail?
2. Why did correct predictions succeed?
3. Why is my model uncertain about a prediction?

special importance:
setting a model *live*, where it's not *prelabeled*

Trusting a Prediction
Requirements

Interpretations must be ...

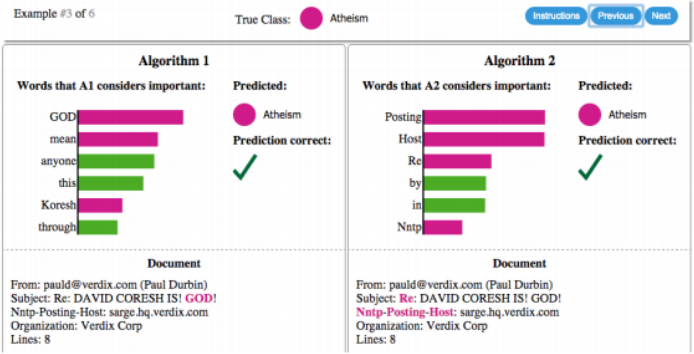
- *human-readable*
- reproducable (same input + same model → same output)
- **model agnostic**, meaning they can work with any (black-box) model

Difficulties:

- Models can be huge (millions of weights)
- Inputvectors can be huge (e.g. images)
- Some models are to complex by it's structure to be readable, (e.g. neural networks)

Example

Desired output of a "Atheism"-Classifier



Document

From: pauld@verdix.com (Paul Durbin)
Subject: Re: DAVID CORESH IS! GOD!
Nntp-Posting-Host: sarge.hq.verdix.com
Organization: Verdix Corp
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Figure: LIME-Text: predicting "Atheism" for given text

Both algorithms predict correct - yet Algorithm 2 has strange reasons.

Trusting a Model

$$\text{trusting predictions} \neq \text{trusting a model}$$

What do we want?

1. get an *overview* of our Model
2. compare models in reasonable time
3. proove correctness & flaws of a model
4. improve our models

Prooving a Model

Several topics which benefit from machine learning, but need special care:

1. Terrorism-detection
2. Medical diagnosis & prescriptions
3. Fraud-detection

Noone will buy a model, if you can't prove that it's performing reasonable predictions.

Improving a Model

There are several issues, at which explanations can help you improve your models:

1. Filtering of Features
2. Find overfitted weighting of features
3. Find Links in Classification (Similiar Classes and Features)

Gaining insights from explanations can help you improve your model!

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Requirements

What do we want:

- Human Readable Model Explanation
- For Every Classifier
- For Every Input

features ≠ human readable

To gain *readability*:

- show influence relative to each other, not as numbers
- only show most important features
- use *superpixels* instead of pixels

Definitions

Let:

1. G be any possible explanation model
2. g be our explanation Model
3. $\Omega(g)$ the complexity of our Model
    - Weights in a regressions model
    - Depth of an decisiontree
    - Number of trees in a random forest
4. $f : Features- > Class$ be the real classification
5. $\Pi_x(z)$ as proximity-measure from x to z
6. $\mathcal{L}(f, g, \Pi_x)$ measure of un-faithfullness of g compared to f given the proxmity Π_x

Minimizing Fidelity · Interpretability

Wanted:

$$\xi(x) = argmin_{g \in G}\ \mathcal{L}(f, g, \Pi_x) + \Omega(g)$$

Read:

- We want for every input x
- an explanation(-model)
- where complexity of g and the failure of g are minimal
- given a set of possible explanations G

We do so by picking samples x' as subsets from an input x and optimizing our model g

Local Interpretable Model-Agnostic Explanations

The LIME-Algorithm

Here is the Pseudocode.

Visualisation

Put the funky red-blue image with the red-crosses from the paper here maybe: Example

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4. Example: Traffic Sign Recognition

Problem with Sampling

Explain that we have to little time to inspect everything Looking for a new way to pick samples

Submodular Pick

The SPLIME Algorithm

Here is the Pseudocode

SPLIME Example

I guess this needs more than 2 Pages, we should add an example

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3 SP-LIME

4 Example: Traffic Sign Recognition

Trafficsign-Recognition

Explaining RandomForests for Textclassification

Setup Problem, Show Code, Plot Examples, nice This could be left out from the presentation, and just be a live demo
Do both: LIME and ANCHOR and sample with SPLIME