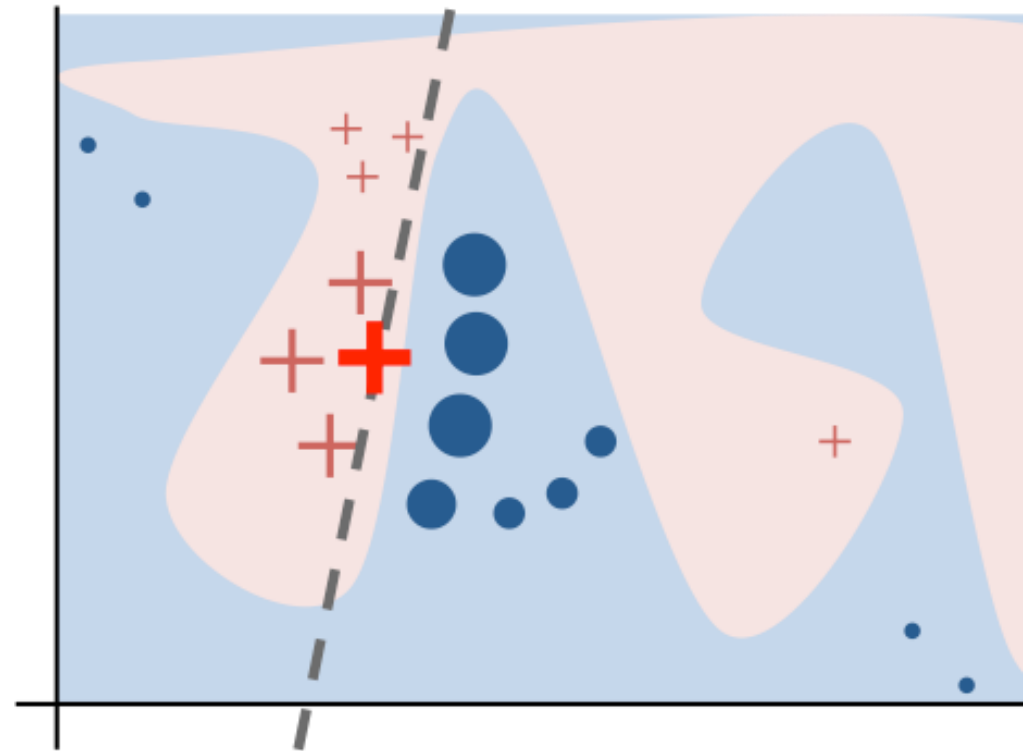Explaining Customer Satisfaction

Yannic Vorpahl, Daniel Pietschmann

AI-Lab Final Presentation

LIME – Local Interpretable Model-Agnostic Explanations

- Library for explaining blackbox models

- Uses a linear model to approach the model which we want to explain

- Just gives local explanations

Our dataset

- Airline Passenger Satisfaction:

  https://www.kaggle.com/teejmahal20/airline-passenger-satisfaction

- based on a Kaggle kernel

- Dataset contains an airline passenger survey

- 23 columns,

Train dataset
103 904 rows

Test dataset
25 976 rows

Datacleaning

	Unnamed: 0	id	Gender	Customer Type	Age	Type of Travel	Class	Flight Distance	Inflight wifi service	Departure/Arrival time convenient	...	Inflight entertainment	On-board service	Leg room service	Baggage handling	Checkin service	Inflight service	Cleanliness	Departure Delay in Minutes	Arrival Delay in Minutes	satisfaction
0	0	70172	Male	Loyal Customer	13	Personal Travel	Eco Plus	460	3	4	...	5	4	3	4	4	5	5	25	18.0	neutral or dissatisfied
1	1	5047	Male	disloyal Customer	25	Business travel	Business	235	3	2	...	1	1	5	3	1	4	1	1	6.0	neutral or dissatisfied
2	2	110028	Female	Loyal Customer	26	Business travel	Business	1142	2	2	...	5	4	3	4	4	4	5	0	0.0	satisfied
3	3	24026	Female	Loyal Customer	25	Business travel	Business	562	2	5	...	2	2	5	3	1	4	2	11	9.0	neutral or dissatisfied
4	4	119299	Male	Loyal Customer	61	Business travel	Business	214	3	3	...	3	3	4	4	3	3	3	0	0.0	satisfied

5 rows × 25 columns

	Gender	Customer Type	Age	Type of Travel	Class	Flight Distance	Inflight wifi service	Departure/Arrival time convenient	Ease of Online booking	Gate location	...	Inflight entertainment	On-board service	Leg room service	Baggage handling	Checkin service	Inflight service	Cleanliness	Departure Delay in Minutes	Arrival Delay in Minutes	satisfaction
0	0	0	1	13	0	1	460	3	4	3	1	...	5	4	3	4	4	5	5	25	18.0	0
1	0	0	0	25	1	2	235	3	2	3	3	...	1	1	5	3	1	4	1	1	6.0	0
2	1	1	1	26	1	2	1142	2	2	2	2	...	5	4	3	4	4	4	5	0	0.0	1
3	1	1	1	25	1	2	562	2	5	5	5	...	2	2	5	3	1	4	2	11	9.0	0
4	0	1	1	61	1	2	214	3	3	3	3	...	3	3	4	4	3	3	3	0	0.0	1

5 rows × 23 columns

```python
def transform_gender(x):
    if x == 'Female':
        return 1
    elif x == 'Male':
        return 0
    else:
        return -1

def transform_customer_type(x):
    if x == 'Loyal Customer':
        return 1
    elif x == 'disloyal Customer':
        return 0
    else:
        return -1


def transform_travel_type(x):
    if x == 'Business travel':
        return 1
    elif x == 'Personal Travel':
        return 0
    else:
        return -1

def transform_class(x):
    if x == 'Business':
        return 2
```
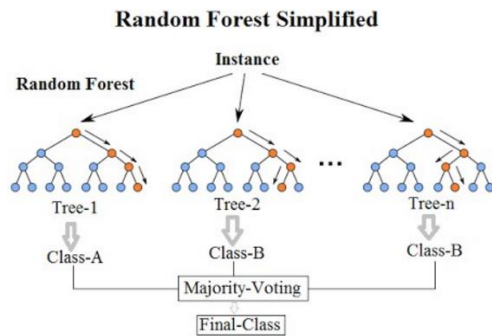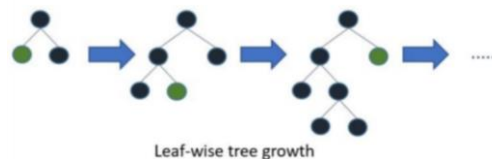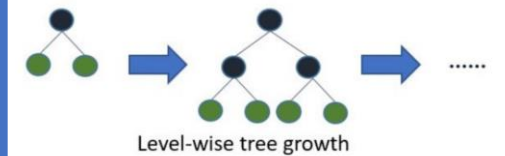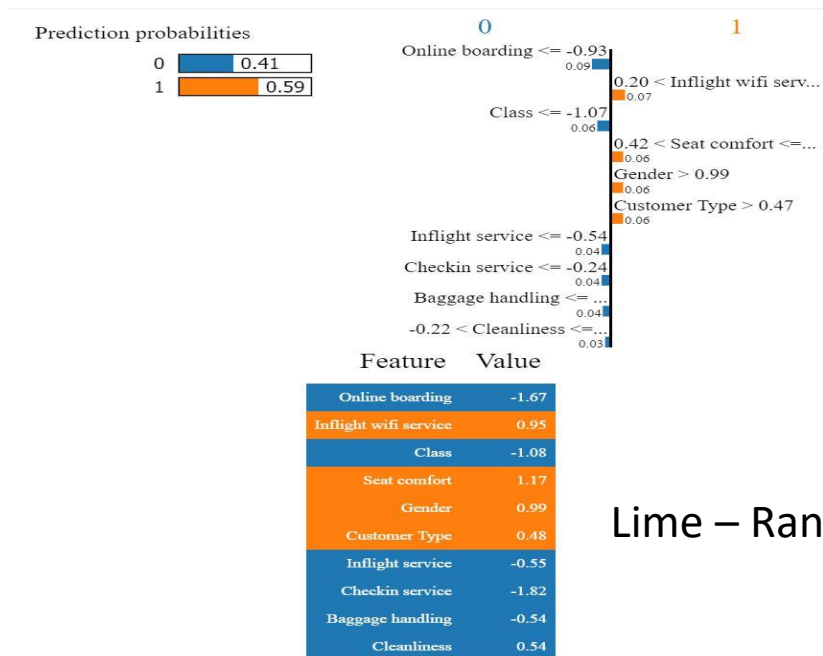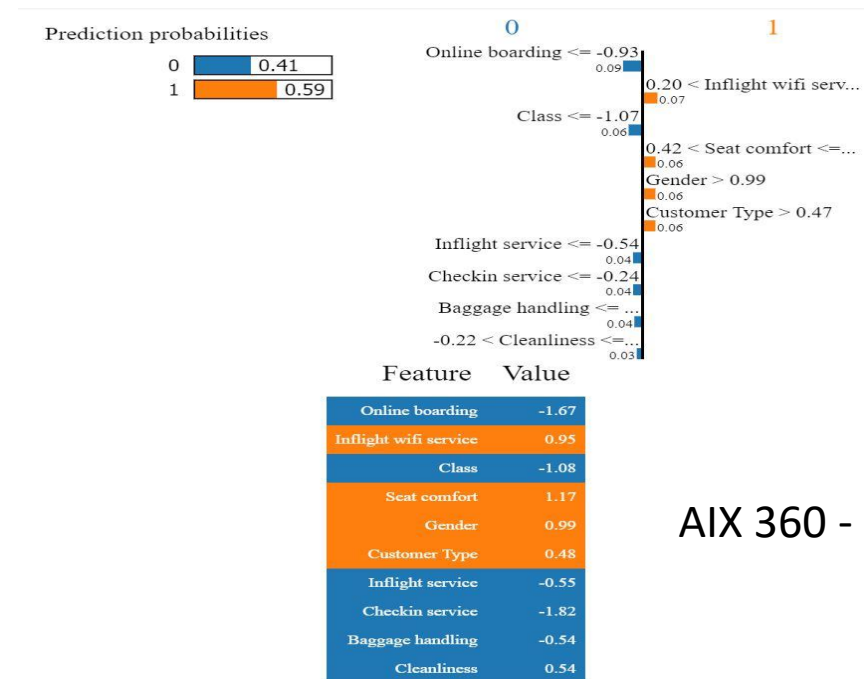
No difference: Lime vs. AIX360

Lime – Random Forest

AIX 360 - Random Forest

Lime - LightGBM

Prediction probabilities
- 0 | 0.13
- 1 | 0.87

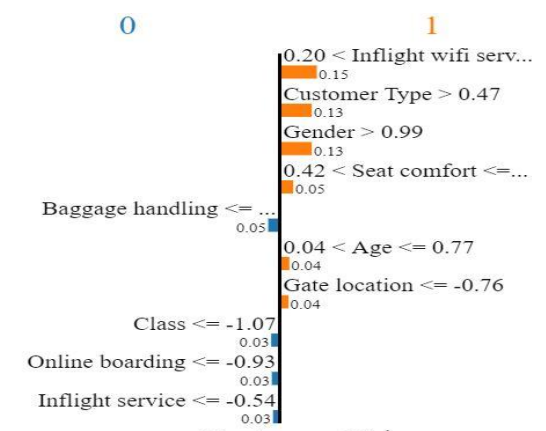|	0	1
Customer Type > 0.47		0.13
Gender > 0.99		0.13
0.20 < Inflight wifi serv...		0.11
Gate location <= -0.76		0.05
Food and drink > 0.60		0.03
Arrival Delay in Minu...	0.03	
Checkin service <= -0.24		0.03
0.04 < Age <= 0.77		0.03
Ease of Online booking...	0.03	
Inflight service <= -0.54	0.03	
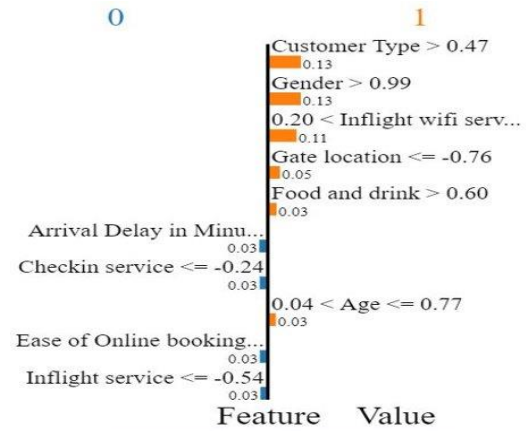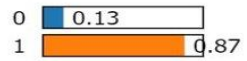
Feature	Value
Customer Type	0.48
Gender	0.99
Inflight wifi service	0.95
Gate location	-1.54
Food and drink	1.34
Arrival Delay in Minutes	0.11
Checkin service	-1.82
Age	0.49
Ease of Online booking	-1.24
Inflight service	-0.55

AIX360 - LightGBM

Prediction probabilities
- 0 | 0.13
- 1 | 0.87

	0	1
0.20 < Inflight wifi serv...		0.15
Customer Type > 0.47		0.13
Gender > 0.99		0.13
0.42 < Seat comfort <=...		0.05
Baggage handling <= ...	0.05	
0.04 < Age <= 0.77		0.04
Gate location <= -0.76		0.04
Class <= -1.07	0.03	
Online boarding <= -0.93	0.03	
Inflight service <= -0.54	0.03	

Feature	Value
Inflight wifi service	0.95
Customer Type	0.48
Gender	0.99
Seat comfort	1.17
Baggage handling	-0.54
Age	0.49
Gate location	-1.54
Class	-1.08
Online boarding	-1.67
Inflight service	-0.55

Problems with Interpret-ml

- no result
- no error messages
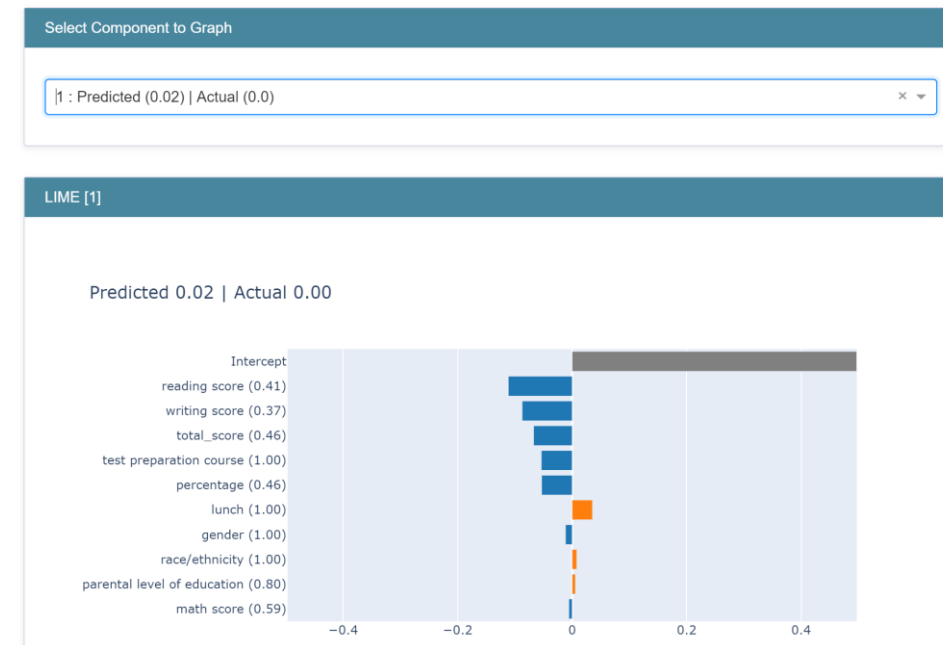
=> Solution: Datatype was list but needed Series

Select Component to Graph
0 : Predicted (0.977)	Actual ([1]) × ▾

LIME (Overall)
No Overall Graph
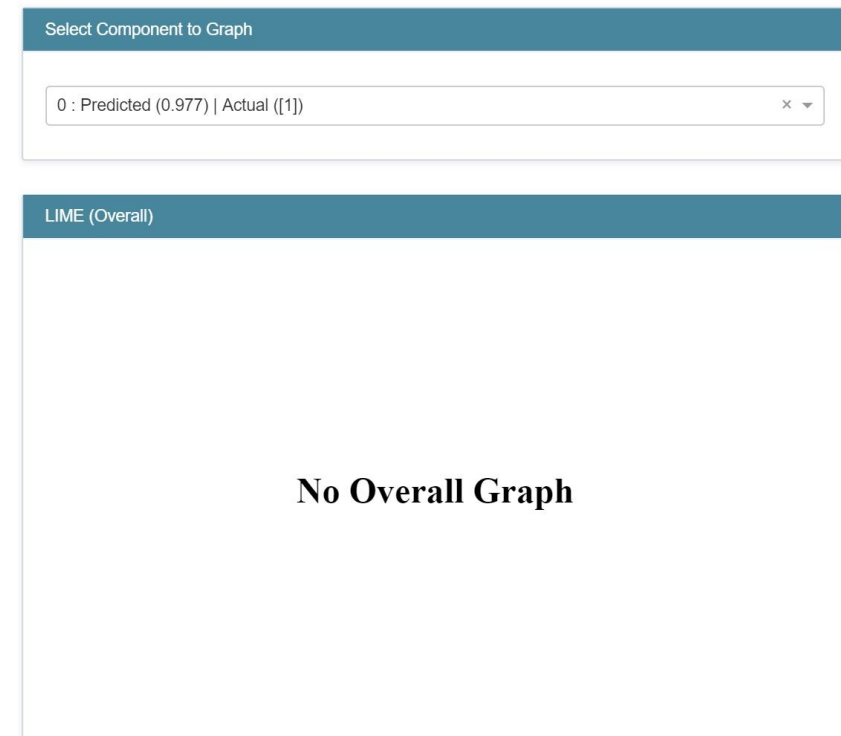
Adaption
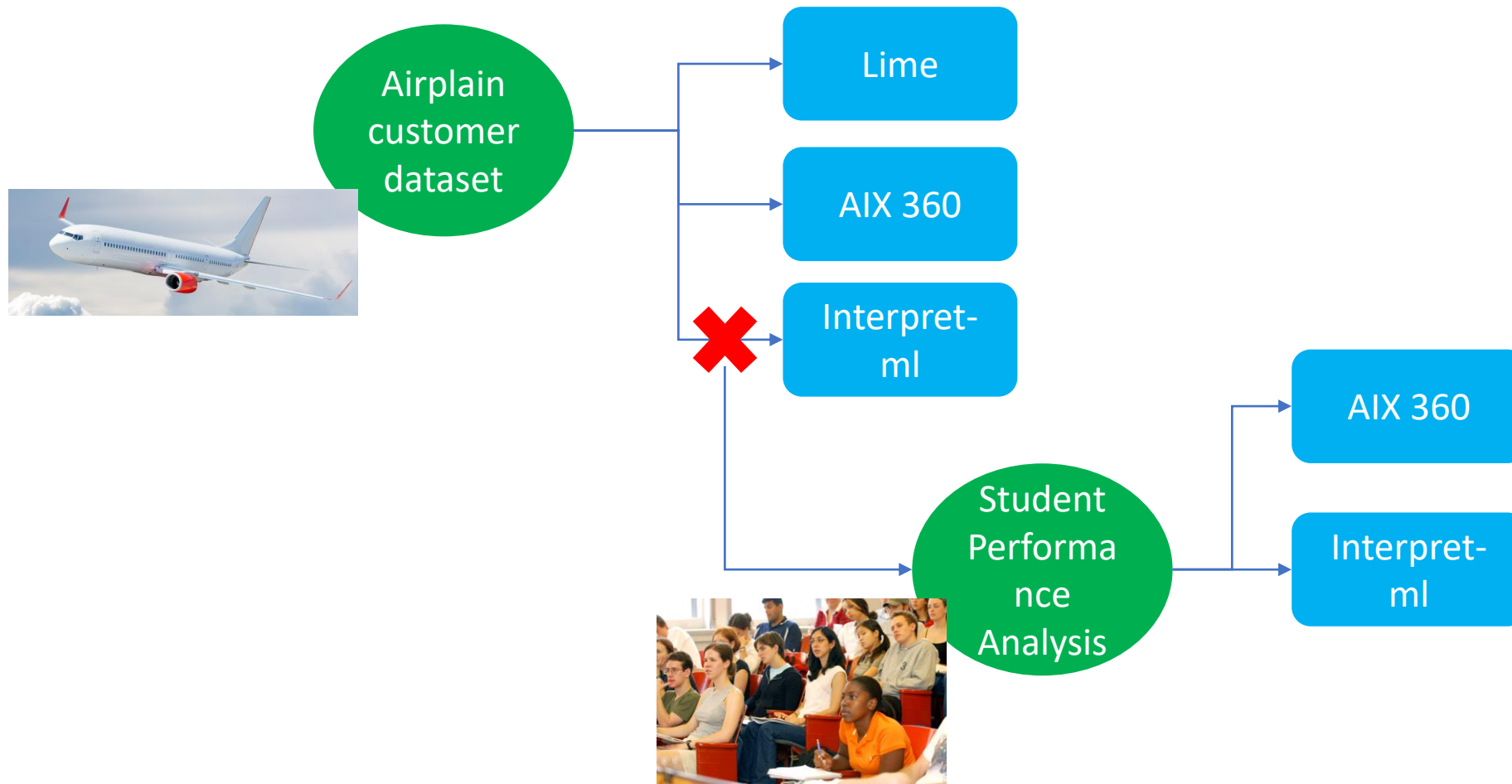
Student performance dataset

	gender	race/ethnicity	parental level of education	lunch	test preparation course	math score	reading score	writing score
0	female	group B	bachelor's degree	standard	none	72	72	74
1	female	group C	some college	standard	completed	69	90	88
2	female	group B	master's degree	standard	none	90	95	93
3	male	group A	associate's degree	free/reduced	none	47	57	44
4	male	group C	some college	standard	none	76	78	75

Select Component to Graph

|1 : Predicted (0.02) | Actual (0.0)

LIME [1]

Predicted 0.02 | Actual 0.00

Intercept
reading score (0.41)
writing score (0.37)
total_score (0.46)
test preparation course (1.00)
percentage (0.46)
lunch (1.00)
gender (1.00)
race/ethnicity (1.00)
parental level of education (0.80)
math score (0.59)

-0.4   -0.2   0   0.2   0.4

- 8 columns
- 1000 rows

AIX360 vs Interpret-Ml

Branch: master ▾   **AIX360** / aix360 / algorithms / lime / **__init__.py** / ‹› Jump to ▾

○ vijay-arya lime integration

0 contributors

1 lines (1 sloc) | 86 Bytes

```
1    from .lime_wrapper import LimeImageExplainer, LimeTabularExplainer, LimeTextExplainer
```

Branch: master ▾   **interpret** / python / interpret-core / interpret / blackb

interpret-ml Refactored interpret to have a subpackage interpret-core, that enable...

1 contributor

7 lines (6 sloc) | 296 Bytes

```
1    # Copyright (c) 2019 Microsoft Corporation
2    # Distributed under the MIT software license
3
4    from .lime import LimeTabular  # noqa: F401
5    from .shap import ShapKernel  # noqa: F401
6    from .sensitivity import MorrisSensitivity  # noqa: F401
7    from .partialdependence import PartialDependence  # noqa: F401
```

Comparison – Lime vs AIX vs Interpret-ml

	Lime	AIX	Interpret-ml
Documentary	Provided	Provided	Not provided
Errors			No visualization, however no error message
Funtionality • Lime Tabular data • Lime Text data • Lime Image data	Provided Provided Provided	Provided Provided Provided	provided Not provided Not provided
conclusion		Easier to use, good documentary	Just github-repo, no real documentary, Nice interface

Thank you for your attention!

InterpretML Customer Satisfaction - Outcome