Introduction to Machine Learning (with Python)

Andreas Mueller

Hi Andy,

I just received an email from the first tutorial speaker, presenting right before you, saying he's ill and won't be able to make it.

I know you have already committed yourself to two presentations, but is there anyway you could increase your tutorial time slot, maybe just offer time to try out what you've taught? Otherwise I have to do some kind of modern dance interpretation of Python in data :-)
-Leah

Hi Andreas,

I am very interested in your Machine Learning background. I work for X Recruiting who have been engaged by Z, a worldwide leading supplier of Y. We are expanding the core engineering team and we are looking for really passionate engineers who want to create their own story and help millions of people.

Can we find a time for a call to chat for a few minutes about this?

Thanks

Hi Andy,

I just received an email fr the first tutorial speaker, presenting u, saying he's ill and won't be

I know you have a urself to two presentations you could increase you , maybe just offer time to try out what you've taught? Otherwise I have to do some kind of modern dance interpretation of Python in data :-)
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Can we find a ti for a few minutes about t

Thanks

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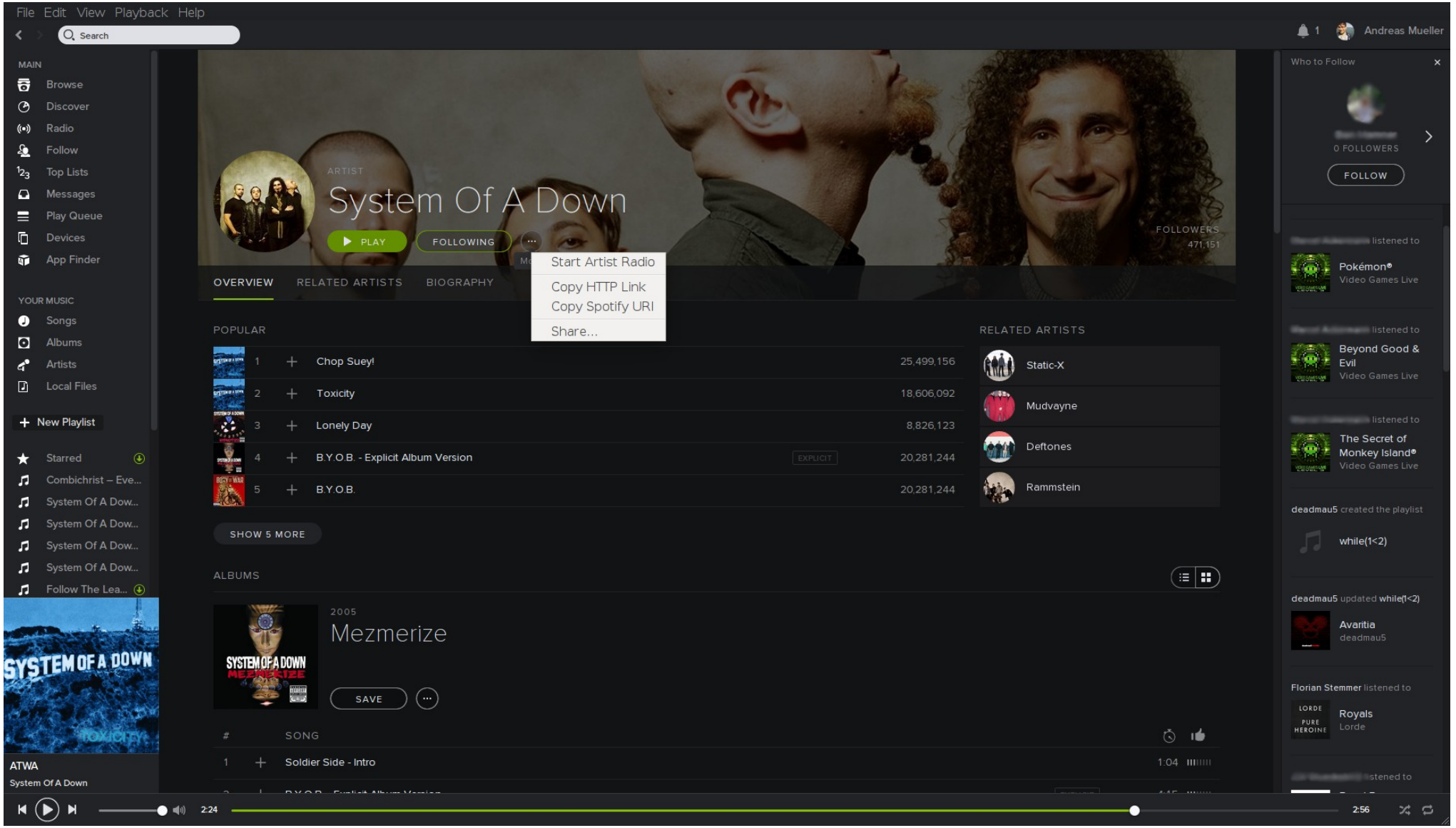
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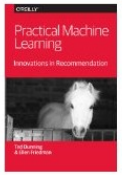

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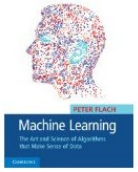

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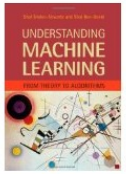

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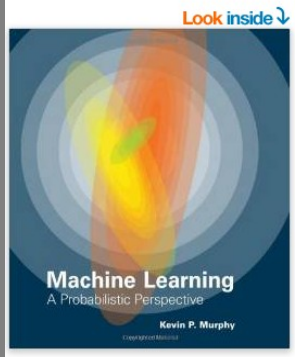

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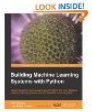
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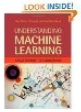
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- Astronomy (finding planets)
- Physics (detecting the Higgs boson)
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- Linguistics (translation, part of speech tagging, parsing trees, language detection, …)
- ...

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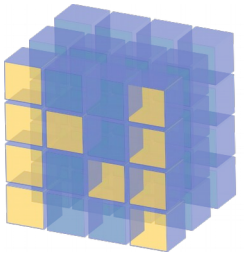
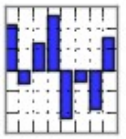


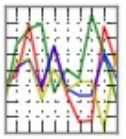
NumPy

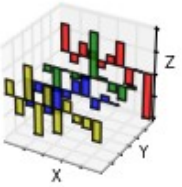
matplotlib

pandas

$$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$$







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Chapter 4 - Working With Text Data. - Mozilla Firefox

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Code Cell Toolbar: None

In [22]:
```
from sklearn.svm import LinearSVC
svm = LinearSVC(C=.01)
```

In [23]:
```
svm.fit(X_train, y_train)
```

Out[23]:
```
LinearSVC(C=0.01, class_weight=None, dual=True, fit_intercept=True,
     intercept_scaling=1, loss='l2', multi_class='ovr', penalty='l2',
     random_state=None, tol=0.0001, verbose=0)
```

In [24]:
```
svm.score(X_train, y_train)
```

Out[24]: 0.88421586014694709

In [25]:
```
svm.score(X_test, y_test)
```

Out[25]: 0.83679637325273892

In [26]:
```
y_test_pred = svm.predict(X_test)
```

In [27]:
```
from sklearn.metrics import classification_report
```

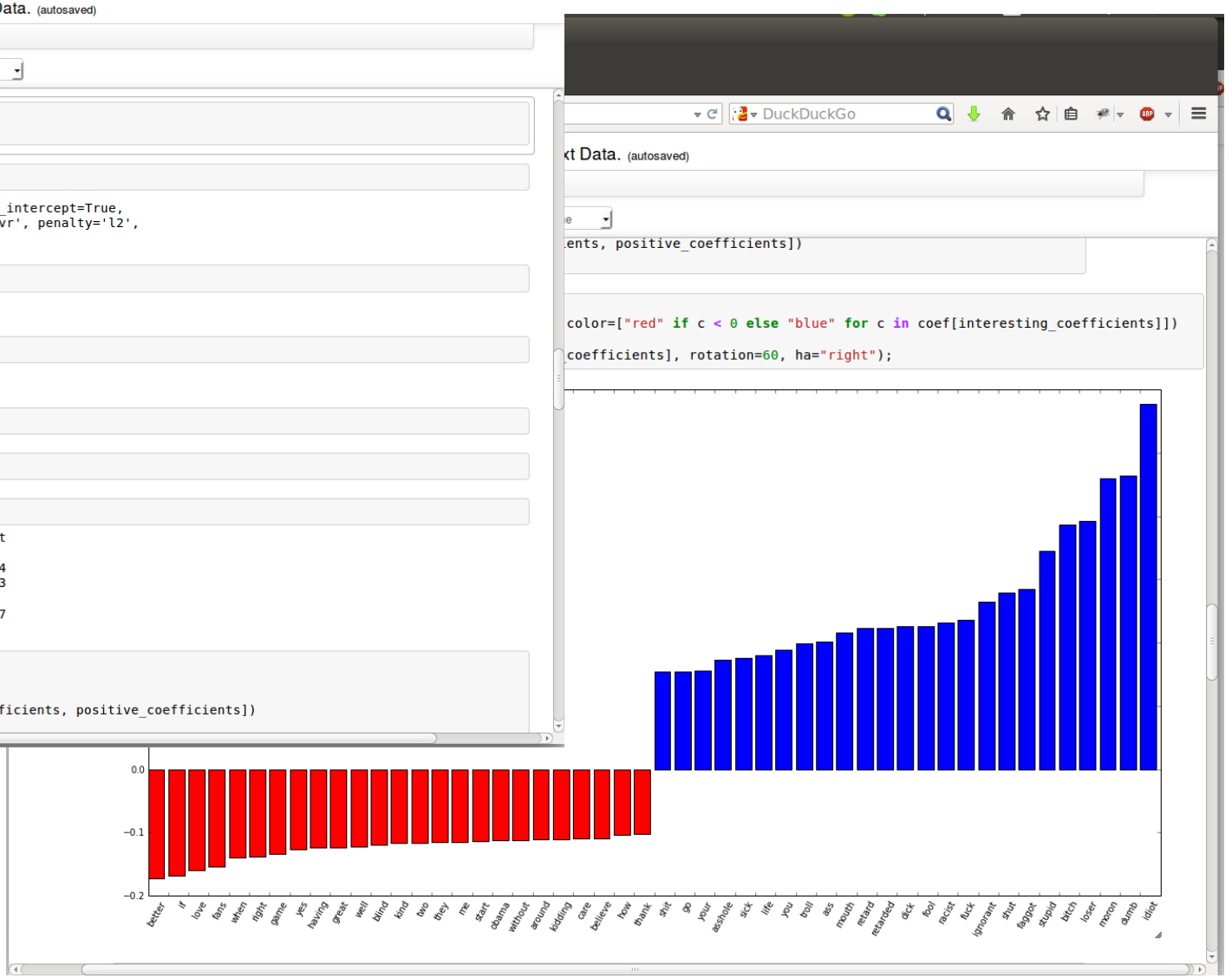
In [28]:
```
print(classification_report(y_test, y_test_pred))
```

```
             precision    recall  f1-score   support

          0       0.84      0.96      0.90      1954
          1       0.82      0.48      0.61       693

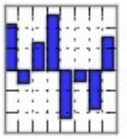
avg / total       0.83      0.84      0.82      2647
```

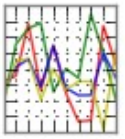
In [29]:
```
coef = svm.coef_.ravel()
positive_coefficients = np.argsort(coef)[-25:]
negative_coefficients = np.argsort(coef)[:25]
interesting_coefficients = np.hstack([negative_coefficients, positive_coefficients])
```

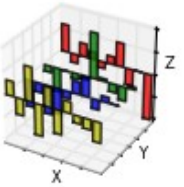


pandas

$$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$$



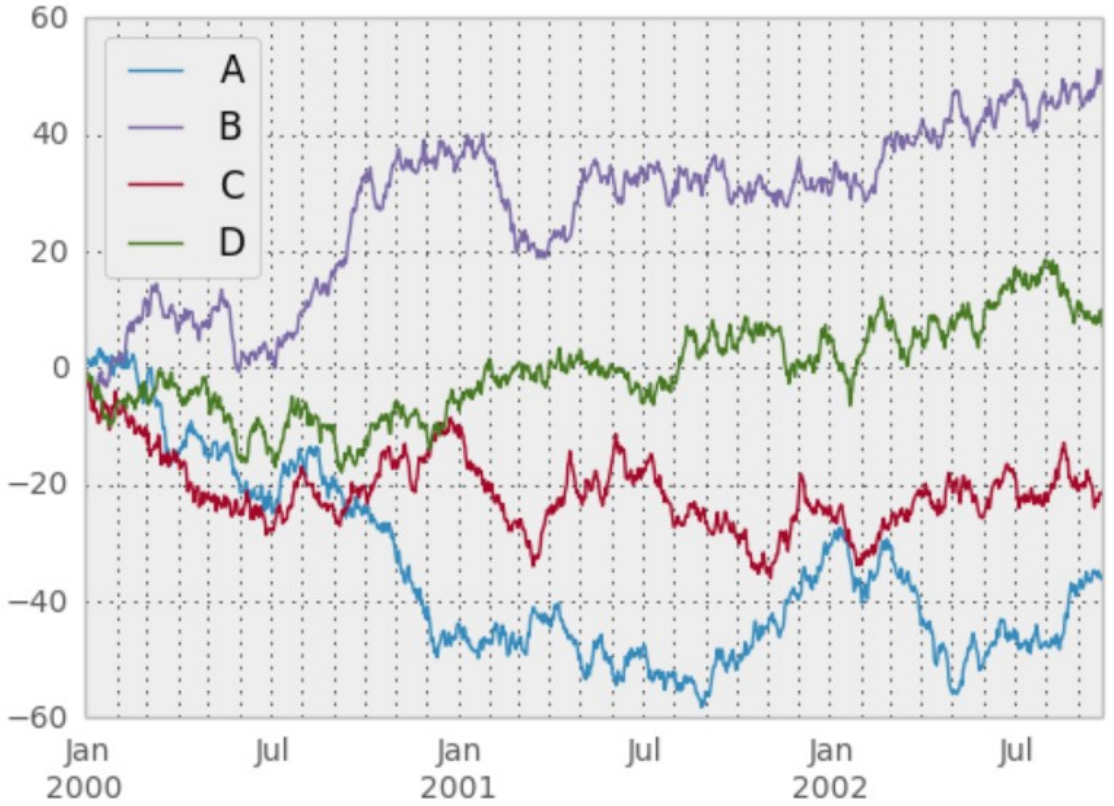


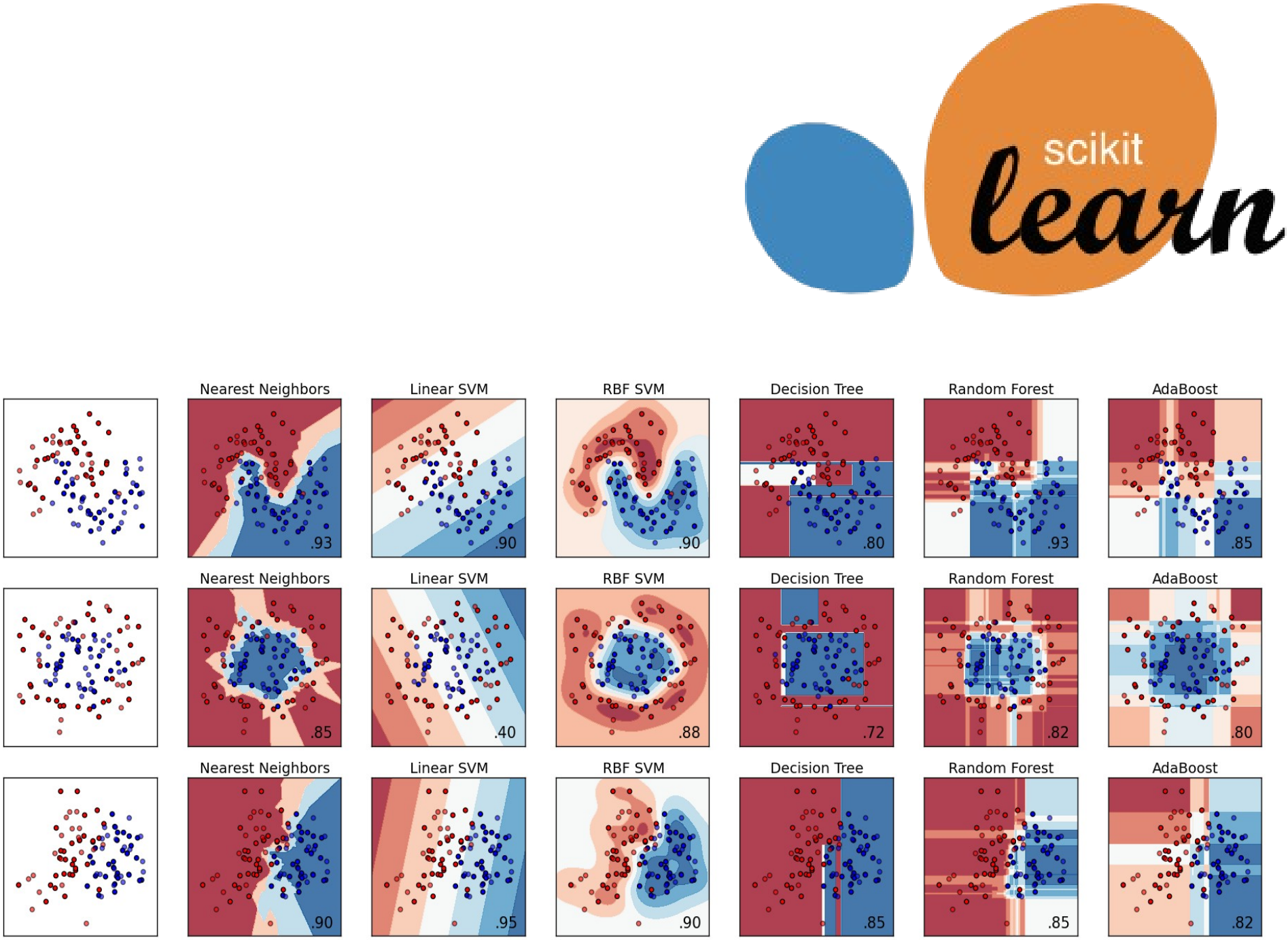



```
In [6]: df = DataFrame(randn(1000, 4), index=ts.index, columns=list('ABCD'))

In [7]: df = df.cumsum()

In [8]: plt.figure(); df.plot();
```

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Linear SVM
RBF SVM
Decision Tree
Random Forest
AdaBoost
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.90
.80
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.85
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RBF SVM
Decision Tree
Random Forest
AdaBoost
.85
.40
.88
.72
.82
.80
Nearest Neighbors
Linear SVM
RBF SVM
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.95
.90
.85
.85
.82

Kinds of Machine Learning

Supervised

- Classification
- Regression
- Ranking
- ...

Unsupervised

- Clustering
- Dimensionality Reduction
- ...

Representing Data

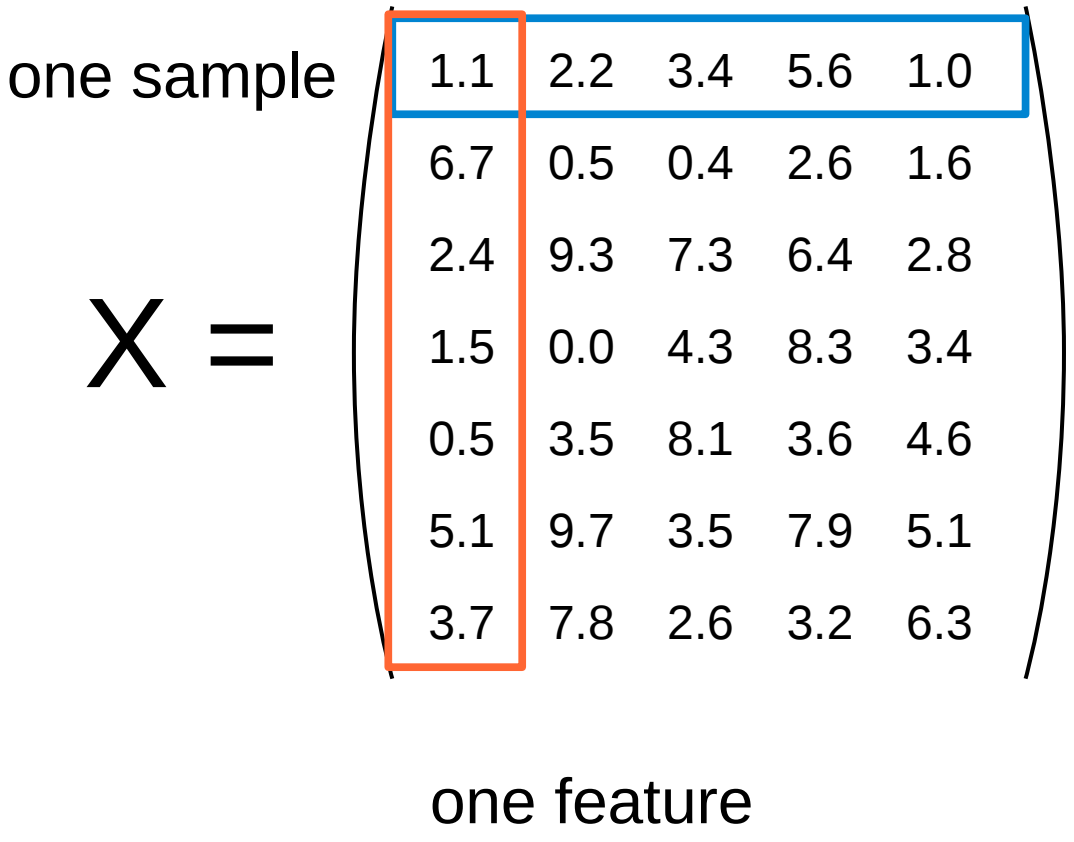
$$X = \begin{pmatrix} 1.1 & 2.2 & 3.4 & 5.6 & 1.0 \\ 6.7 & 0.5 & 0.4 & 2.6 & 1.6 \\ 2.4 & 9.3 & 7.3 & 6.4 & 2.8 \\ 1.5 & 0.0 & 4.3 & 8.3 & 3.4 \\ 0.5 & 3.5 & 8.1 & 3.6 & 4.6 \\ 5.1 & 9.7 & 3.5 & 7.9 & 5.1 \\ 3.7 & 7.8 & 2.6 & 3.2 & 6.3 \end{pmatrix}$$

Representing Data

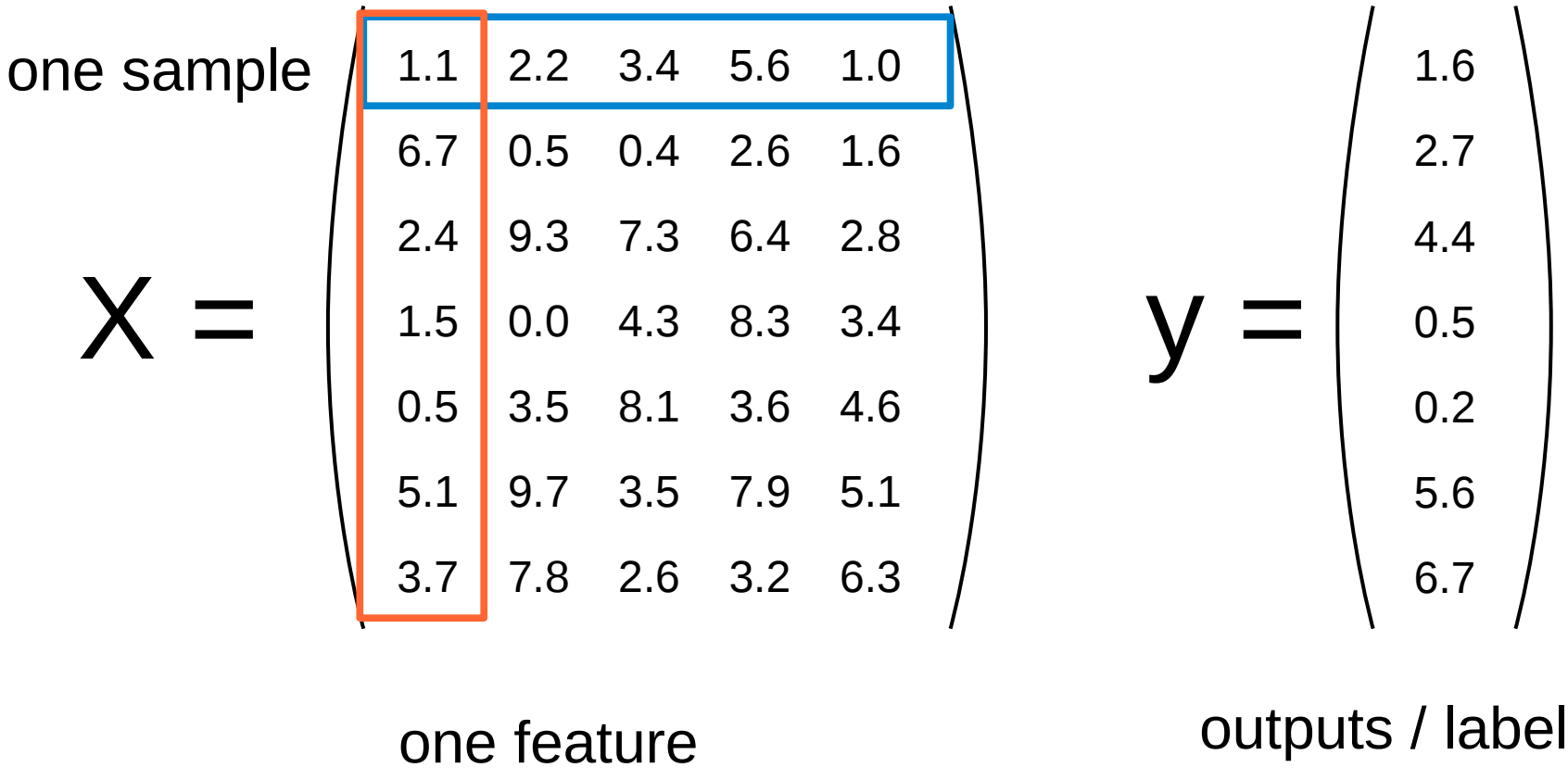
one sample

$$X = \begin{pmatrix} 1.1 & 2.2 & 3.4 & 5.6 & 1.0 \\ 6.7 & 0.5 & 0.4 & 2.6 & 1.6 \\ 2.4 & 9.3 & 7.3 & 6.4 & 2.8 \\ 1.5 & 0.0 & 4.3 & 8.3 & 3.4 \\ 0.5 & 3.5 & 8.1 & 3.6 & 4.6 \\ 5.1 & 9.7 & 3.5 & 7.9 & 5.1 \\ 3.7 & 7.8 & 2.6 & 3.2 & 6.3 \end{pmatrix}$$

Representing Data



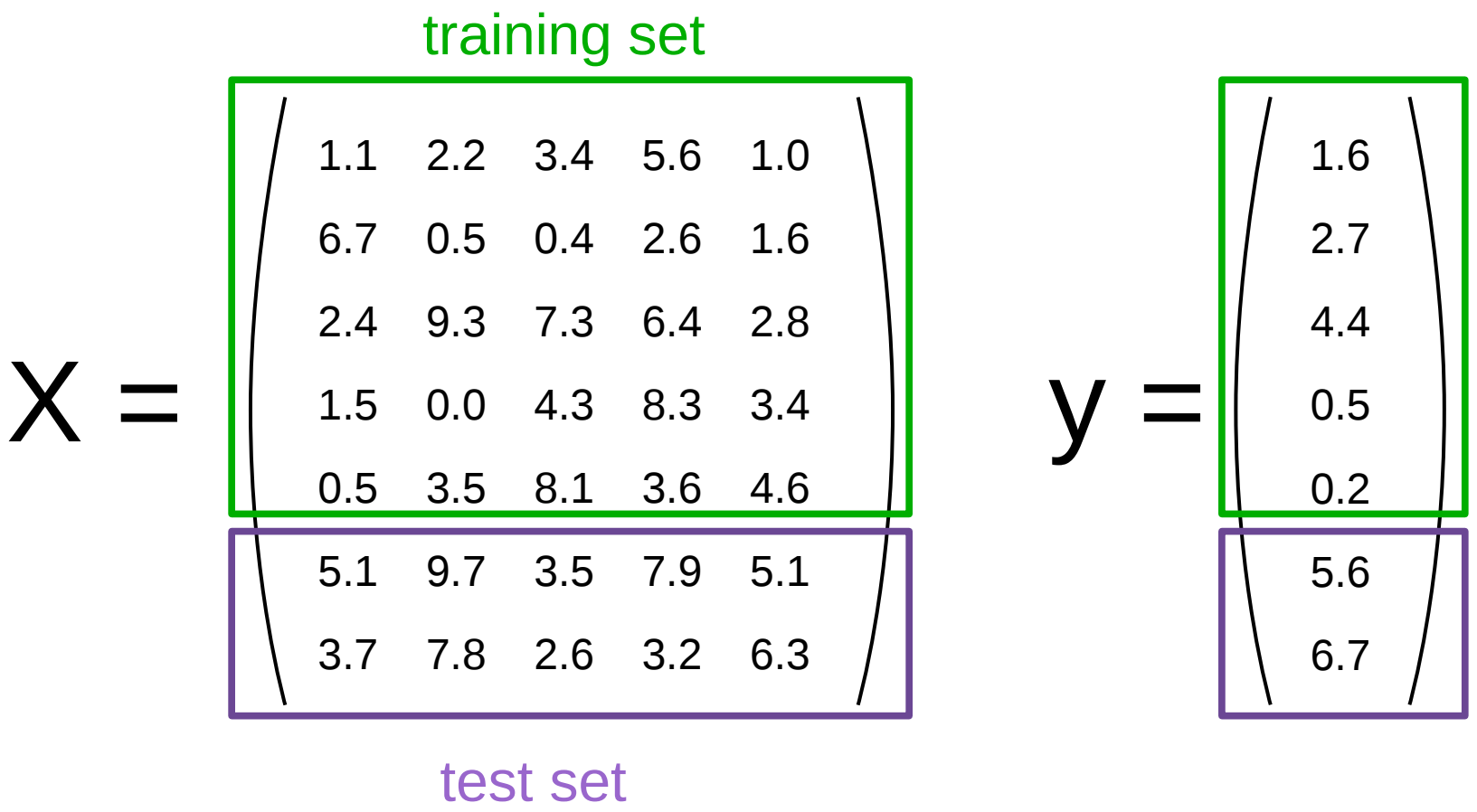
Representing Data



Training and Testing Data

$$X = \begin{pmatrix} 1.1 & 2.2 & 3.4 & 5.6 & 1.0 \\ 6.7 & 0.5 & 0.4 & 2.6 & 1.6 \\ 2.4 & 9.3 & 7.3 & 6.4 & 2.8 \\ 1.5 & 0.0 & 4.3 & 8.3 & 3.4 \\ 0.5 & 3.5 & 8.1 & 3.6 & 4.6 \\ 5.1 & 9.7 & 3.5 & 7.9 & 5.1 \\ 3.7 & 7.8 & 2.6 & 3.2 & 6.3 \end{pmatrix} \quad y = \begin{pmatrix} 1.6 \\ 2.7 \\ 4.4 \\ 0.5 \\ 0.2 \\ 5.6 \\ 6.7 \end{pmatrix}$$

Training and Testing Data



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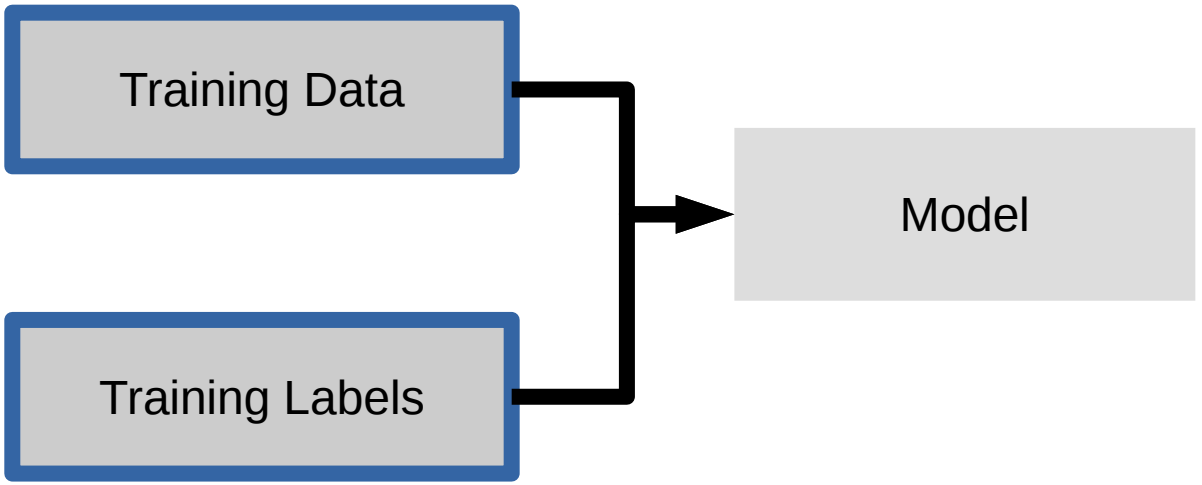
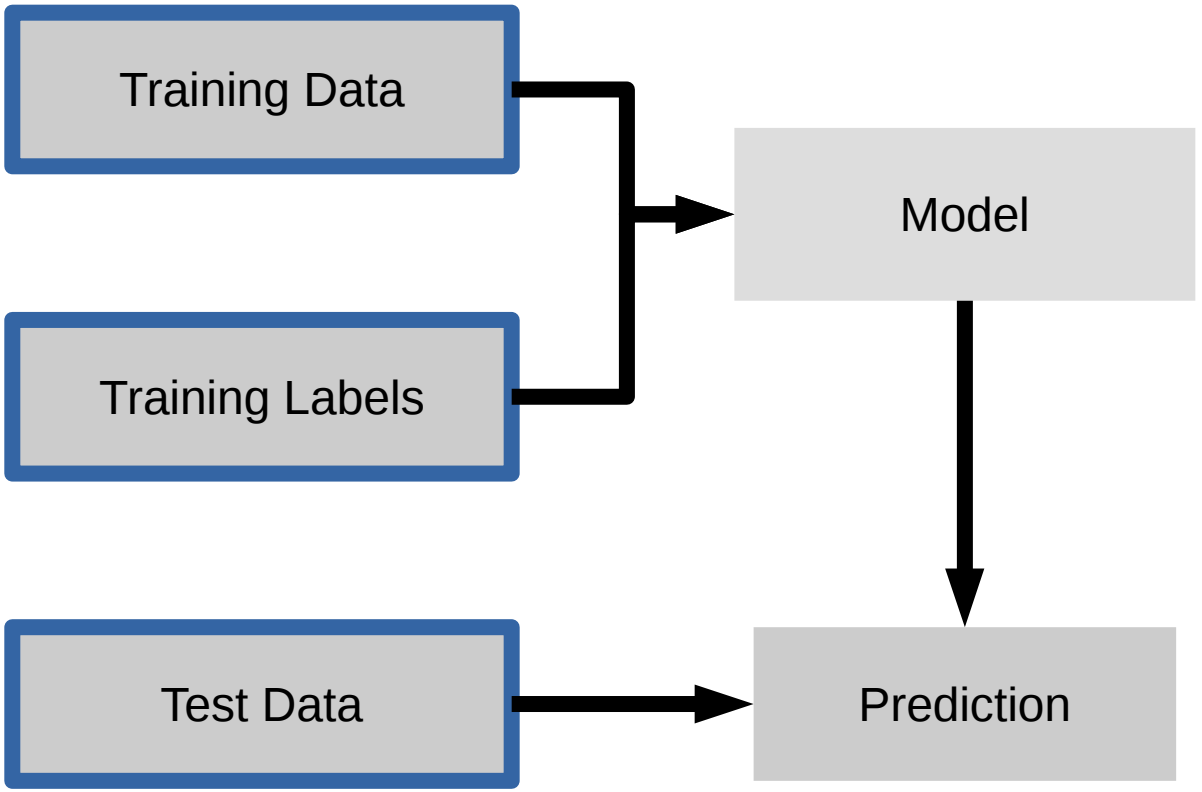
Part 0 – Data Loading

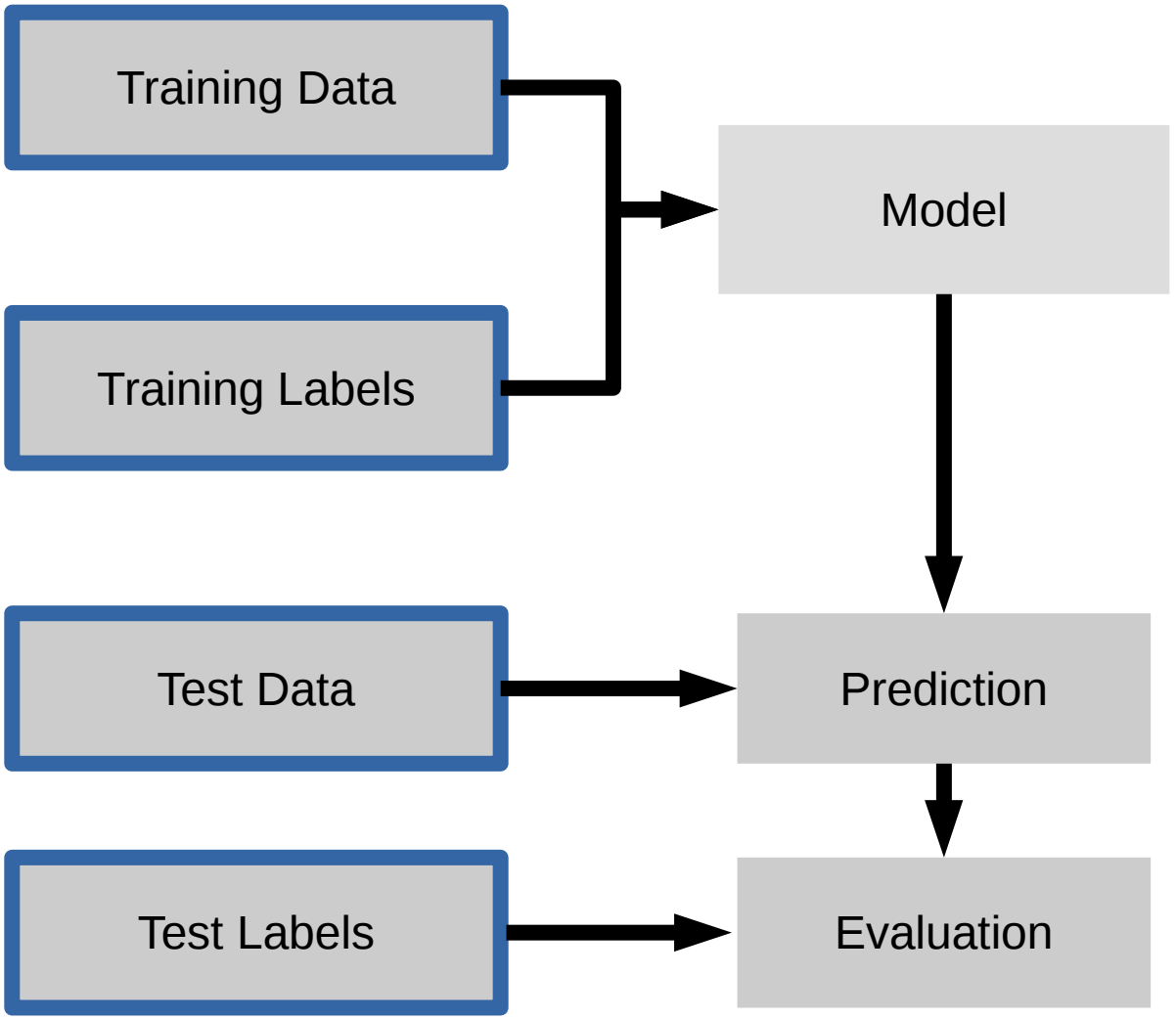
Supervised Machine Learning



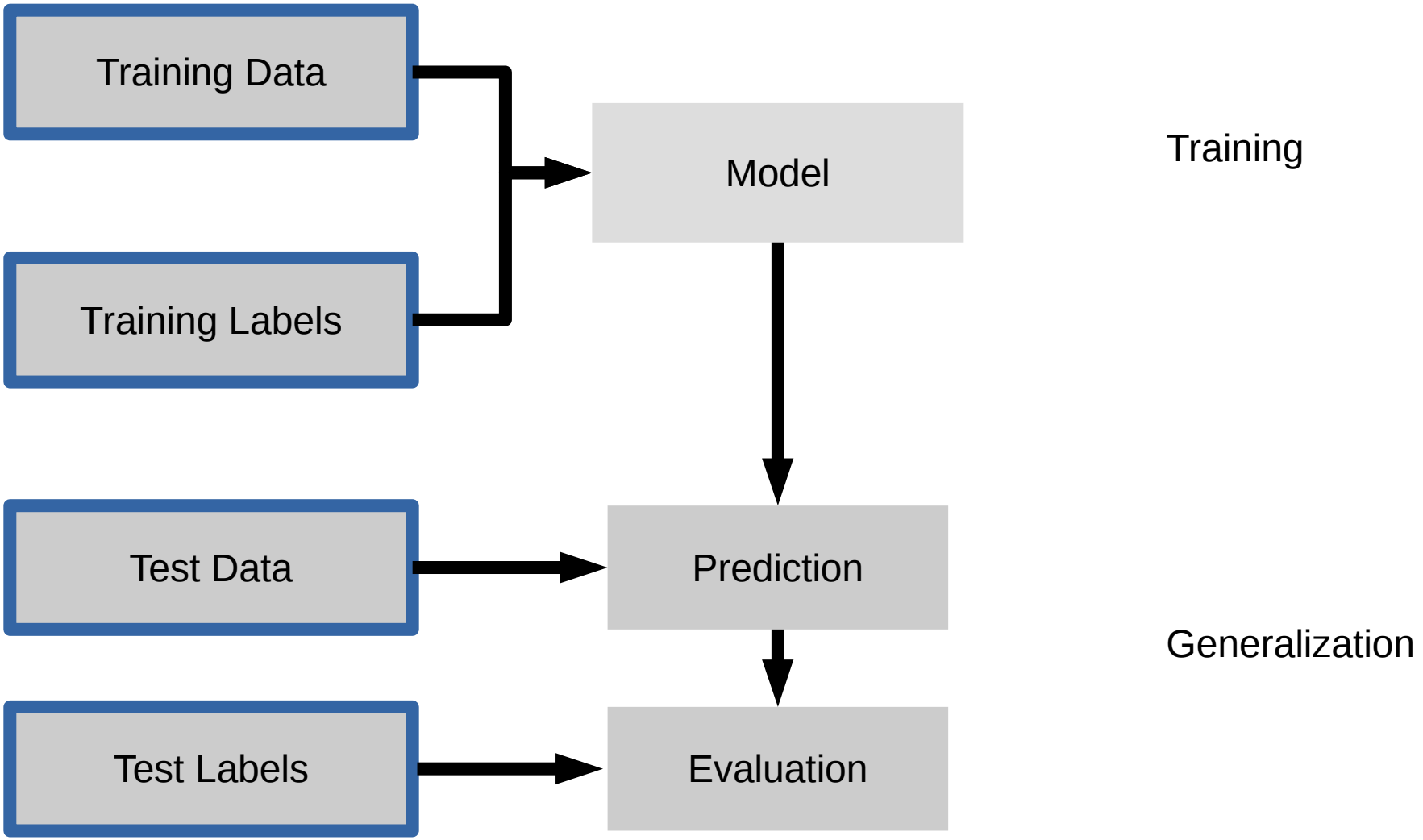
Supervised Machine Learning



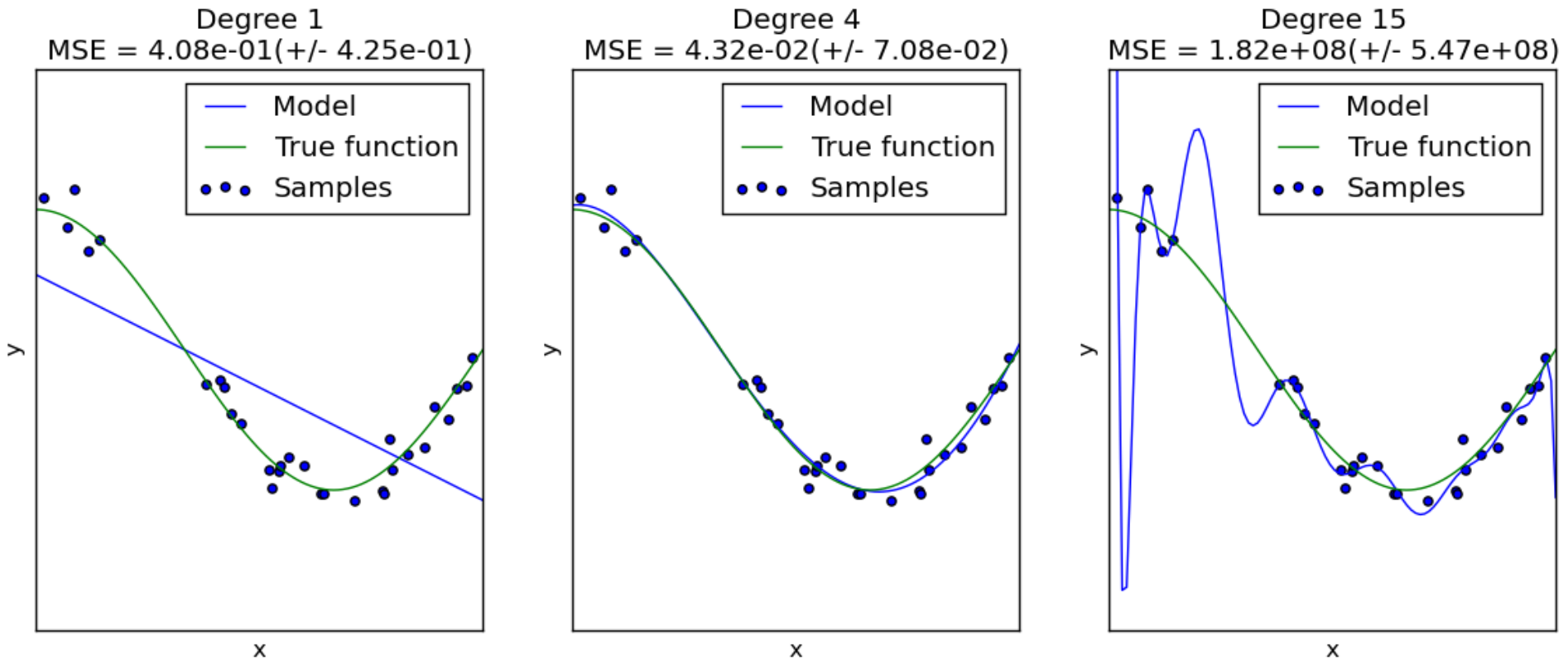
Supervised Machine Learning



Supervised Machine Learning



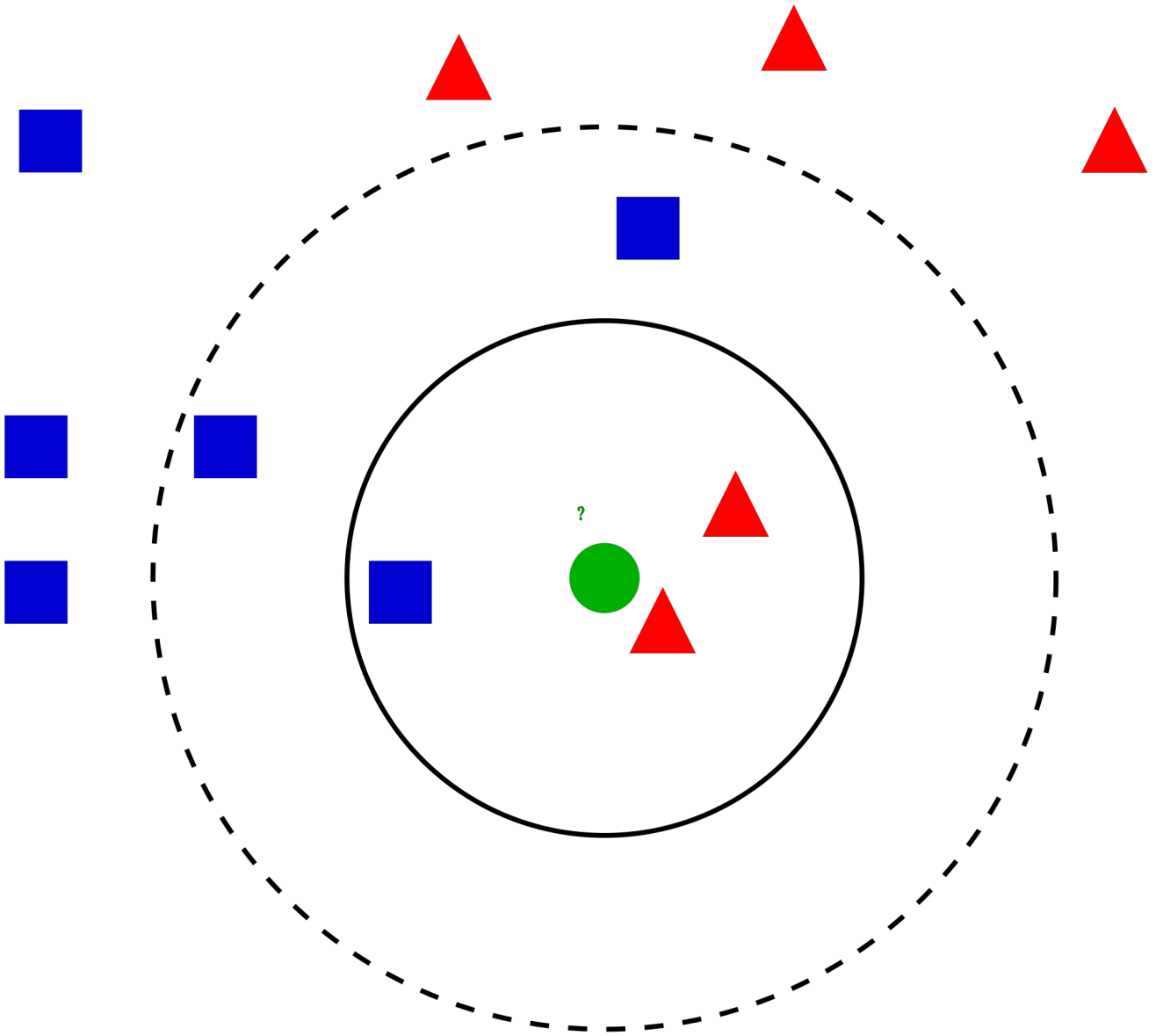
Fitting Polynomials of Varying Degrees



Let's see some algorithms

Classification

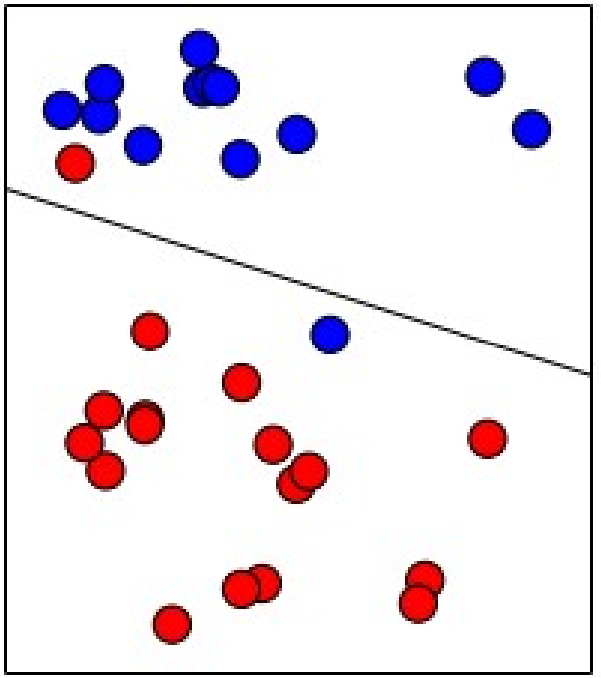
K Nearest Neighbors



source: wikipedia

Logistic Regression

$$\hat{y} = w_0 + \sum_i w_i x_i > 0$$

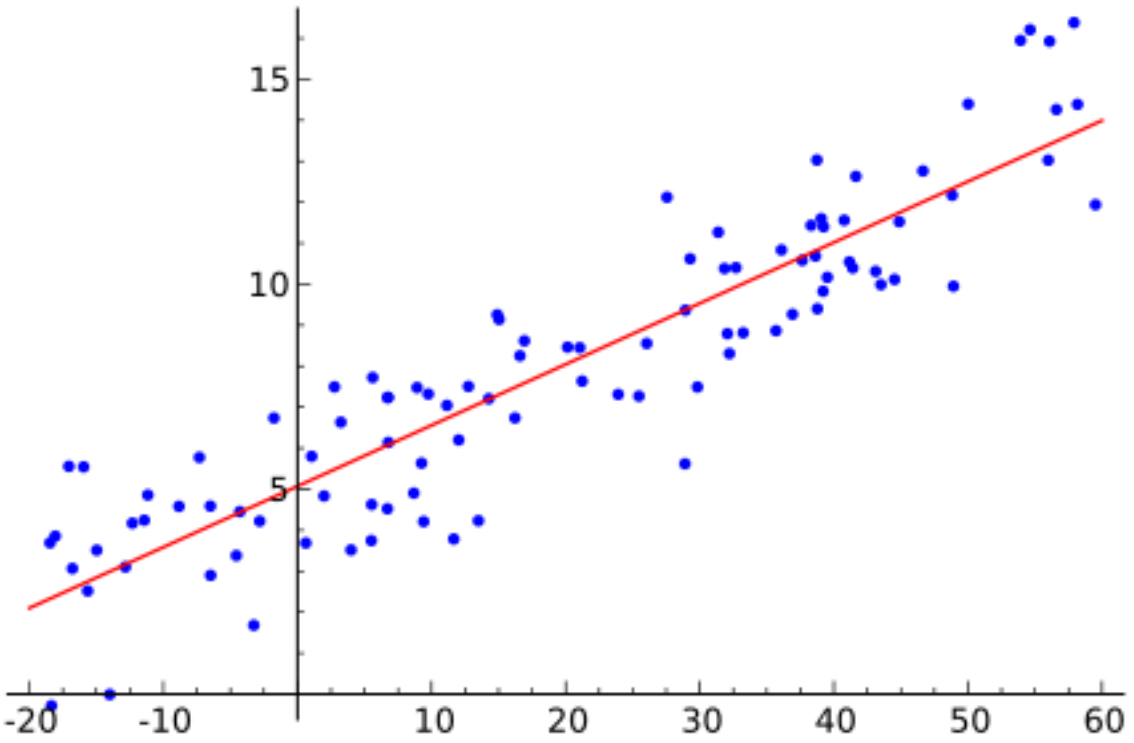


IPython Notebook:
1 Classification

Regression

Linear Regression

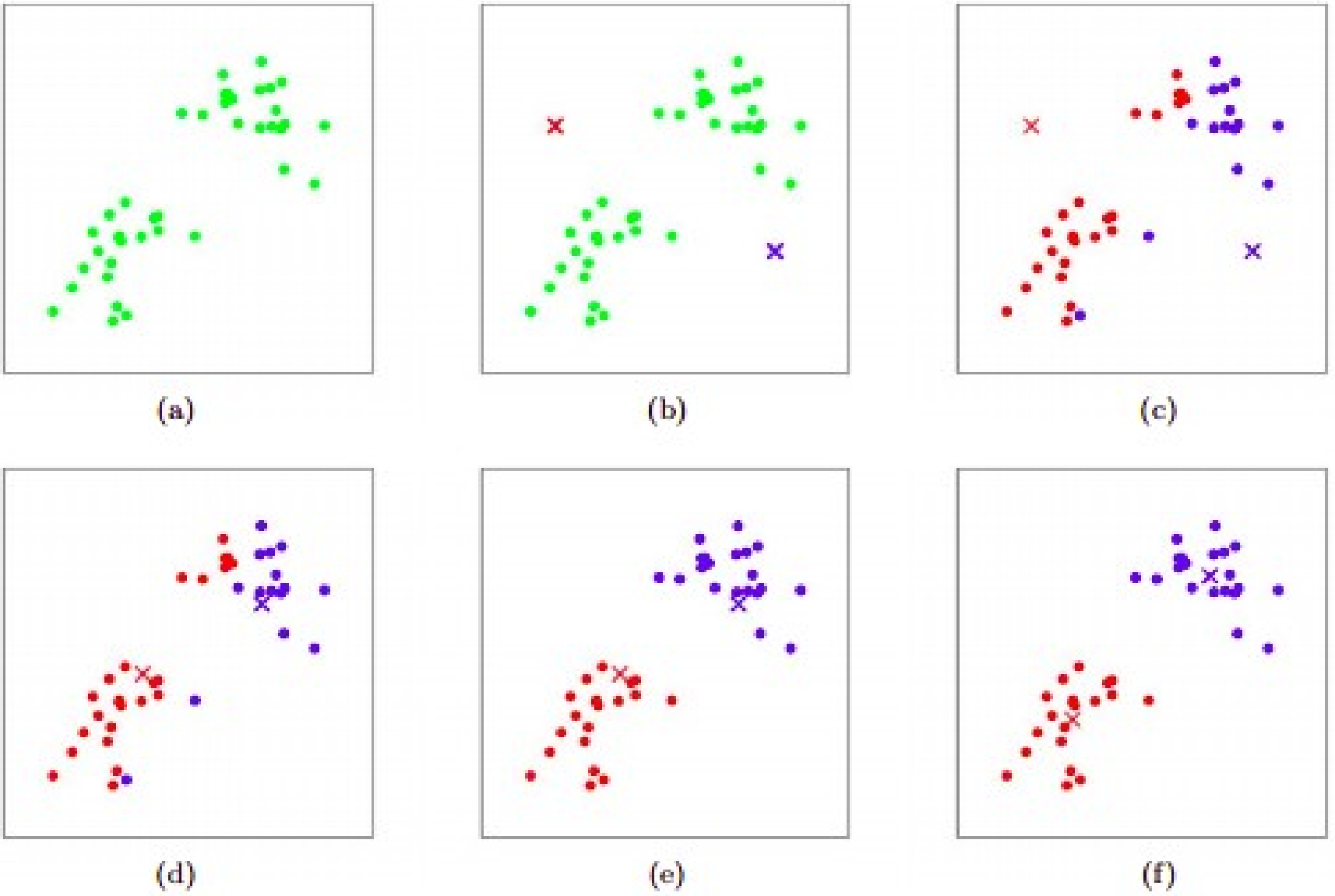
$$\hat{y} = w_0 + \sum_i w_i x_i$$



IPython Notebook:
2 Regression

Clustering

K Means



source: http://stanford.edu/~cpiech/cs221

IPython Notebook:
3 Clustering

Sample application: Sentiment Analysis

IMDB Movie Reviews Data

Review:
One of the worst movies I've ever rented. Sorry it had one of my favorite actors on it (Travolta) in a nonsense role. In fact, anything made sense in this movie.

Who can say there was true love between Eddy and Maureen? Don't you remember the beginning of the movie ?

Is she so lovely? Ask her daughters. I don't think so.

Label: negative

Training data: 12500 positive, 12500 negative

Bag Of Word Representations

`CountVectorizer / TfidfVectorizer`

Bag Of Word Representations

`CountVectorizer / TfidfVectorizer`

`“This is how you get ants.”`

Bag Of Word Representations

`CountVectorizer / TfidfVectorizer`

`“This is how you get ants.”`

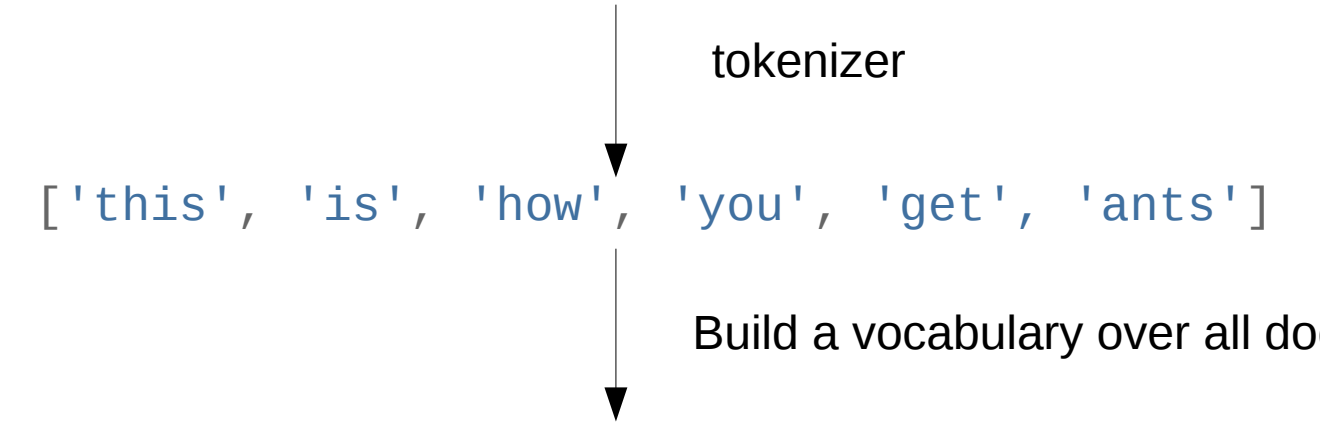
tokenizer

```
['this', 'is', 'how', 'you', 'get', 'ants']
```

Bag Of Word Representations

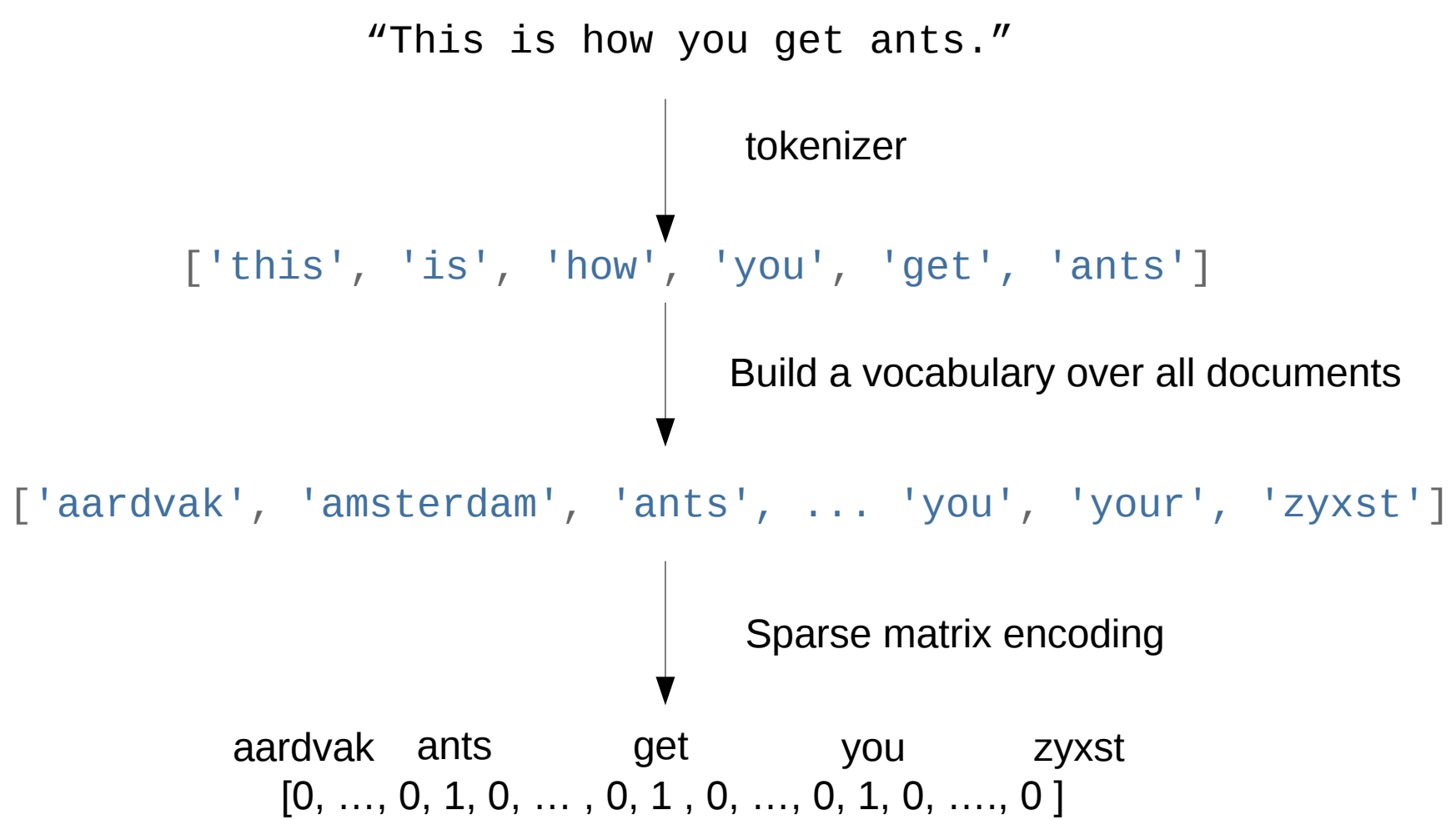
`CountVectorizer / TfidfVectorizer`

`“This is how you get ants.”`



Bag Of Word Representations

`CountVectorizer / TfidfVectorizer`



N-grams (unigrams and bigrams)

`CountVectorizer / TfidfVectorizer`

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N-grams (unigrams and bigrams)

`CountVectorizer / TfidfVectorizer`

`“This is how you get ants.”`

Unigram tokenizer

```
['this', 'is', 'how', 'you', 'get', 'ants']
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N-grams (unigrams and bigrams)

`CountVectorizer / TfidfVectorizer`

`“This is how you get ants.”`

Unigram tokenizer

`['this', 'is', 'how', 'you', 'get', 'ants']`

`“This is how you get ants.”`

Bigram tokenizer

`['this is', 'is how', 'how you', 'you get', 'get ants']`

IPython Notebook:
4 Working With Text Data

Video Series
Advanced Machine Learning with scikit-learn

50% Off Coupon Code: AUTHD

Video Series
Advanced Machine Learning with scikit-learn

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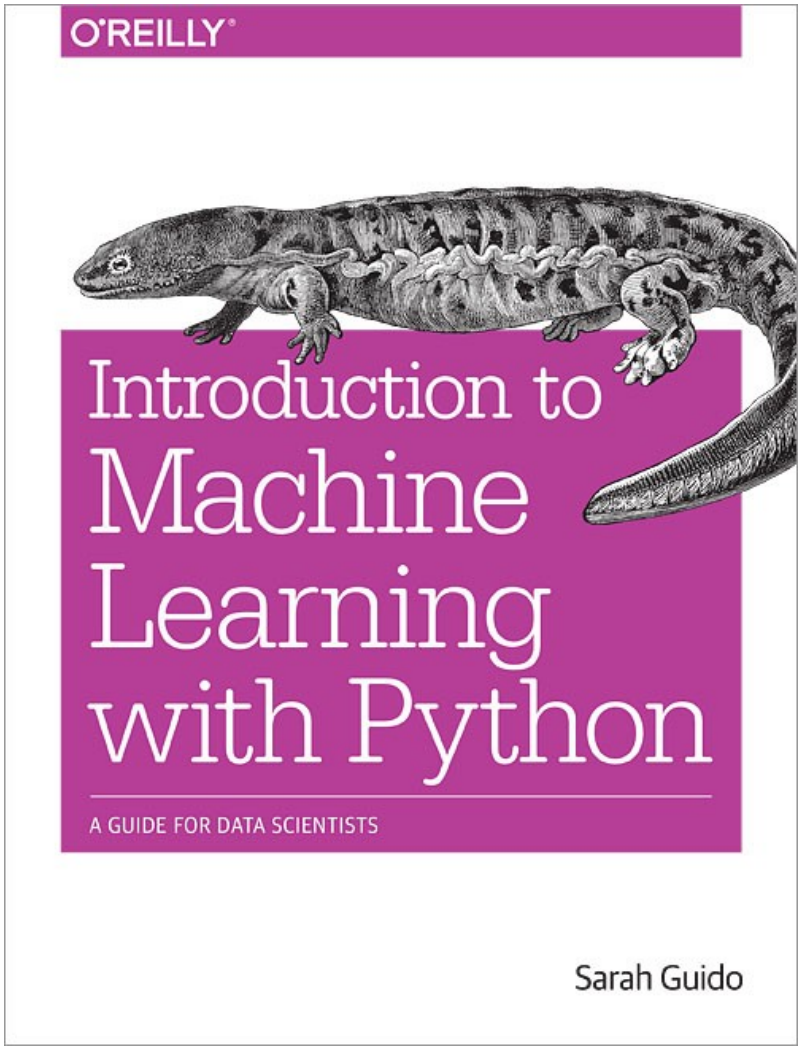
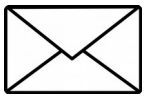


Thank you for your attention.


@t3kcit


@amueller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