Standardizing Data

PREPROCESSING FOR MACHINE LEARNING IN PYTHON

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What is standardization?

- Scikit-learn models assume normally distributed data
- Log normalization and feature scaling in this course
- Applied to continuous numerical data

When to standardize: models

- Model in linear space
- Dataset features have high variance
- Dataset features are continuous and on different scales
- Linearity assumptions

Let's practice!

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Log normalization

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What is log normalization?

- Applies log transformation
- Natural log using the constant *e* (2.718)
- Captures relative changes, the magnitude of change, and keeps everything in the positive space

Number	Log
30	3.4
300	5.7
3000	8

Log normalization in Python

```
print(df)
```

```
   col1   col2
0  1.00    3.0
1  1.20   45.5
2  0.75   28.0
3  1.60  100.0
```

```
print(df.var())
```

```
col1        0.128958
col2     1691.729167
dtype: float64
```

```
import numpy as np
df["log_2"] = np.log(df["col2"])
print(df)
```

```
   col1   col2     log_2
0  1.00    3.0  1.098612
1  1.20   45.5  3.817712
2  0.75   28.0  3.332205
3  1.60  100.0  4.605170
```

```
print(np.var(df[["col1", "log_2"]]))
```

```
col1        0.096719
log_2       1.697165
dtype: float64
```

Let's practice!

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Scaling data

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What is feature scaling?

- Features on different scales
- Model with linear characteristics
- Center features around 0 and transform to unit variance
- Transforms to approximately normal distribution

How to scale data

```
print(df)
```

```
   col1  col2   col3
0  1.00  48.0  100.0
1  1.20  45.5  101.3
2  0.75  46.2  103.5
3  1.60  50.0  104.0
```

```
print(df.var())
```

```
col1    0.128958
col2    4.055833
col3    3.526667
dtype: float64
```

How to scale data

```
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler()
df_scaled = pd.DataFrame(scaler.fit_transform(df),
                                    columns=df.columns)
```

```
print(df_scaled)
```

```
       col1      col2      col3
0 -0.442127  0.329683 -1.352726
1  0.200967 -1.103723 -0.553388
2 -1.245995 -0.702369  0.799338
3  1.487156  1.476409  1.106776
```

```
print(df.var())
```

```
col1    1.333333
col2    1.333333
col3    1.333333
dtype: float64
```

Let's practice!

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Standardized data and modeling

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K-nearest neighbors

```
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
```

```
# Preprocessing first
X_train, X_test, y_train, y_test = train_test_split(X, y)
```

```
knn = KNeighborsClassifier()
knn.fit(X_train, y_train)
```

```
knn.score(X_test, y_test)
```

Let's practice!

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