PREPROCESSING FOR MACHINE LEARNING IN PYTHON

Feature engineering

Sarah Guido
Senior Data Scientist

What is feature engineering?

- Creation of new featured based on existing features
- Insight into relationships between features
- Extract and expand data
- Dataset-dependent

Feature engineering scenarios

Id	Text
1	"Feature engineering is fun!"
2	"Feature engineering is a lot of work."
3	"I don't mind feature engineering."

user	fav_color
1	blue
2	green
3	orange

Feature engineering scenarios

Id	Date
4	July 30 2011
5	January 29 2011
6	February 05 2011

user	test1	test2	test3
1	90.5	89.6	91.4
2	65.5	70.6	67.3
3	78.1	80.7	81.8

PREPROCESSING FOR MACHINE LEARNING IN PYTHON

Let's practice!

PREPROCESSING FOR MACHINE LEARNING IN PYTHON

Encoding categorical variables

Sarah Guido
Senior Data Scientist

Categorical variables

```
   user subscribed fav_color
0     1          y      blue
1     2          n     green
2     3          n    orange
3     4          y     green
```

Encoding binary variables - Pandas

```
In [1]: print(users["subscribed"])

0    y
1    n
2    n
3    y
Name: subscribed, dtype: object

In [2]: users["sub_enc"] = users["subscribed"].apply(lambda val:
                                                     1 if val == "y" else 0)

In [3]: print(users[["subscribed", "sub_enc"]])

  subscribed  sub_enc
0          y        1
1          n        0
2          n        0
3          y        1
```

Encoding binary variables - scikit-learn

```
In [4]: from sklearn.preprocessing import LabelEncoder

In [5]: le = LabelEncoder()
In [6]: users["sub_enc_le"] = le.fit_transform(users["subscribed"])

In [7]: print(users[["subscribed", "sub_enc_le"]])

  subscribed  sub_enc_le
0          y           1
1          n           0
2          n           0
3          y           1
```

One-hot encoding

fav_color
blue
green
orange
green

fav_color_enc
[1, 0, 0]
[0, 1, 0]
[0, 0, 1]
[0, 1, 0]

Values: [blue, green, orange]

- blue: [1, 0, 0]
- green: [0, 1, 0]
- orange: [0, 0, 1]

One-hot encoding

```
In [8]: print(users["fav_color"])

0      blue
1     green
2    orange
3     green
Name: fav_color, dtype: object

In [9]: print(pd.get_dummies(users["fav_color"]))

   blue  green  orange
0     1      0       0
1     0      1       0
2     0      0       1
3     0      1       0
```

PREPROCESSING FOR MACHINE LEARNING IN PYTHON

Let's practice!

PREPROCESSING FOR MACHINE LEARNING IN PYTHON

Engineering numerical features

Sarah Guido
Senior Data Scientist

Aggregate statistics

```
In [1]: print(df)

     city  day1  day2  day3
0     NYC  68.3  67.9  67.8
1      SF  75.1  75.5  74.9
2      LA  80.3  84.0  81.3
3  Boston  63.0  61.0  61.2

In [2]: columns = ["day1", "day2", "day3"]

In [3]: df["mean"] = df.apply(lambda row: row[columns].mean(), axis=1)

In [4]: print(df)

     city  day1  day2  day3   mean
0     NYC  68.3  67.9  67.8  68.00
1      SF  75.1  75.5  74.9  75.17
2      LA  80.3  84.0  81.3  81.87
3  Boston  63.0  61.0  61.2  61.73
```

Dates

```
In [5]: print(df)

                date purchase
0      July 30 2011   $45.08
1  February 01 2011   $19.48
2   January 29 2011   $76.09
3     March 31 2012   $32.61
4  February 05 2011   $75.98

In [6]: df["date_converted"] = pd.to_datetime(df["date"])

In [7]: df["month"] = df["date_converted"].apply(lambda row: row.month)

In [8]: print(df)

                date purchase date_converted  month
0      July 30 2011   $45.08     2011-07-30      7
1  February 01 2011   $19.48     2011-02-01      2
2   January 29 2011   $76.09     2011-01-29      1
3     March 31 2012   $32.61     2012-03-31      3
4  February 05 2011   $75.98     2011-02-05      2
```

PREPROCESSING FOR MACHINE LEARNING IN PYTHON

Let's practice!

PREPROCESSING FOR MACHINE LEARNING IN PYTHON

Engineering features from text

Sarah Guido
Senior Data Scientist

Extraction

```
In [1]: import re

In [2]: my_string = "temperature:
                     75.6 F"

In [3]: pattern =
           re.compile("\d+\.\d+")

In [4]: temp = re.match(pattern,
                        my_string)

In [5]: print(float(temp.group(0))

75.6
```

- \d+
- \.
- \d+

Vectorizing text

- tf = term frequency
- idf = inverse document frequency

Vectorizing text

```
In [6]: from sklearn.feature_extraction.text import TfidfVectorizer

In [7]: print(documents.head())

0    Building on successful events last summer and ...
1                Build a website for an Afghan business
2    Please join us and the students from Mott Hall...
3    The Oxfam Action Corps is a group of dedicated...
4    Stop 'N' Swap reduces NYC's waste by finding n...

In [8]: tfidf_vec = TfidfVectorizer()
In [9]: text_tfidf = tfidf_vec.fit_transform(documents)
```

Text classification

$$P(A|B) = \frac{P(B|A)P(A)}{P(B)}$$

PREPROCESSING FOR MACHINE LEARNING IN PYTHON

Let's practice!