

# Feature engineering

PREPROCESSING FOR MACHINE LEARNING IN PYTHON



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# What is feature engineering?

**Feature engineering:** Creation of new features from existing ones

- Improve performance
- Insight into relationships between features
- Need to understand the data first!
- Highly 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

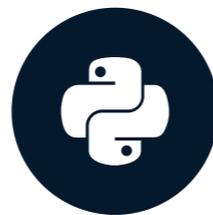
user	test1	test2	test3
1	90.5	89.6	91.4
2	65.5	70.6	67.3
3	78.1	80.7	81.8

# Let's practice!

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# Encoding categorical variables

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# 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

```
print(users["subscribed"])
```

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

```
print(users[["subscribed", "sub_enc"]])
```

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

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

# Encoding binary variables - scikit-learn

```
from sklearn.preprocessing import LabelEncoder

le = LabelEncoder()
users["sub_enc_le"] = le.fit_transform(users["subscribed"])

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

Values: [blue, green, orange]

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

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

```
print(users["fav_color"])
```

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

```
print(pd.get_dummies(users["fav_color"]))
```

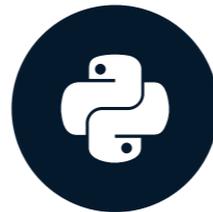
```
   blue  green  orange
0     1     0     0
1     0     1     0
2     0     0     1
3     0     1     0
```

# Let's practice!

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# Engineering numerical features

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```
print(temps)
```

```
   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
```

```
temps["mean"] = temps.loc[:, "day1": "day3"].mean(axis=1)
```

```
print(temps)
```

```
   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

```
print(purchases)
```

```
      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
```

# Dates

```
purchases["date_converted"] = pd.to_datetime(purchases["date"])
purchases['month'] = purchases["date_converted"].dt.month
print(purchases)
```

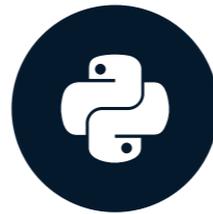
```
   date purchase date_converted  month
0  July 30 2011    $45.08    2011-07-30    7
1  February 01 2011    $19.48    2011-02-01    2
2  January 29 2011    $76.09    2011-01-29    1
3  March 31 2012    $32.61    2012-03-31    3
4  February 05 2011    $75.98    2011-02-05    2
```

# Let's practice!

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# Engineering text features

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# Extraction

- Regular expressions: code to identify patterns

```
import re
my_string = "temperature:75.6 F"
temp = re.search("\d+\.\d+", my_string)

print(float(temp.group(0)))
```

75.6

- `\d+`
- `\.`
- `\d+`

# Vectorizing text

TF/IDF: Vectorizes words based upon importance

- TF = Term Frequency
- IDF = Inverse Document Frequency

# Vectorizing text

```
from sklearn.feature_extraction.text import TfidfVectorizer
```

```
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...
```

```
tfidf_vec = TfidfVectorizer()  
text_tfidf = tfidf_vec.fit_transform(documents)
```

# Text classification

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

# Let's practice!

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