Creating dummies

INTERMEDIATE PREDICTIVE ANALYTICS IN PYTHON

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Motivation for creating dummy variables (1)

Logistic regression: $logit(a_1x_1 + a_2x_2 + ... + a_nx_n + b)$

donor_id	gender	country	segment
5	F	India	Gold
3	M	USA	Silver
2	M	India	Bronze
8	F	UK	Silver
1	F	USA	Bronze

Motivation for creating dummy variables (2)

Logistic regression: $logit(a_1x_1 + a_2x_2 + ... + a_nx_n + b)$

donor_id	gender	country	segment	gender_F	gender_M
5	F	India	Gold	1	0
3	M	USA	Silver	0	1
2	M	India	Bronze	0	1
8	F	UK	Silver	1	0
1	F	USA	Bronze	1	0

Preventing Multicollinearity (1)

donor_id	gender	gender_F	gender_M
5	F	1	0
3	M	0	1
2	M	0	1
8	F	1	0
1	F	1	0

Preventing Multicollinearity (2)

donor_id	gender	gender_F
5	F	1
3	M	0
2	M	0
8	F	1
1	F	1

Preventing Multicollinearity (3)

donor_id	country	country_USA	country_India	country_UK
5	India	0	1	0
3	USA	1	0	0
2	India	0	1	0
8	UK	0	0	1
1	USA	1	0	0

Preventing Multicollinearity (4)

donor_id	country	country_USA	country_India
5	India	0	1
3	USA	1	0
2	India	0	1
8	UK	0	0
1	USA	1	0

Adding dummy variables in Python

```
    donor_id segment
0      32770   Gold
1      32776   Silver
2      32777   Bronze
3      65552   Bronze
```

```python
# Create the dummy variable
dummies_segment = pd.get_dummies(basetable["segment"],drop_first=True)
# Add the dummy variable to the basetable
basetable = pd.concat([basetable, dummies_segment], axis=1)
# Delete the original variable from the basetable
del basetable["segment"]
```

```
    donor_id Gold Silver
0      32770   1    0
1      32776   0    1
2      32777   0    0
3      65552   0    0
```

Let's practice!

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Missing values

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Replacing missing values by an aggregate (1)

donor_id	age
5	-
3	25
2	36
8	40
1	26

Replacing missing values by an aggregate (2)

donor_id	age
5	**38**
3	25
2	36
8	40
1	26

Mean age: 38

Replacing missing values by an aggregate (3)

donor_id	max_donation
5	-
3	1 000 000
2	100
8	40
1	120

Mean `max_donation` : 25 065

Median `max_donation` : 110

Replacing missing values by an aggregate (4)

donor_id	max_donation
5	110
3	1 000 000
2	100
8	40
1	120

Mean `max_donation` : 25 065

Median `max_donation` : 110

Replacing missing values by a fixed value (1)

donor_id	sum_donations
5	130
3	10
2	-
8	40
1	120

Replacing missing values by a fixed value (2)

donor_id	sum_donations
5	130
3	10
2	**0**
8	40
1	120

Replacing missing values in Python

```
# Replace missing values by 0
replacement = 0
basetable["donations_last_year"] =
    basetable["donations_last_year"].fillna(replacement)
# Replace missing values by mean
replacement = basetable["age"].mean()
basetable["age"] = basetable["age"].fillna(replacement)
```

Missing value dummies

```
    donor_id email
0     32770  person32770@provider.com
1     32776  nan
2     32777  person32777@provider.com
3     65552  nan
```

```
basetable["no_email"] = pd.Series(
                            [0 if email==email else 1
                            for email in basetable["email"]])
```

```
      donor_id email                    no_email
0     32770  person32770@provider.com   0
1     32776  nan                        1
2     32777  person32777@provider.com   0
3     65552  nan                        1
```

Let's practice!

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Handling outliers

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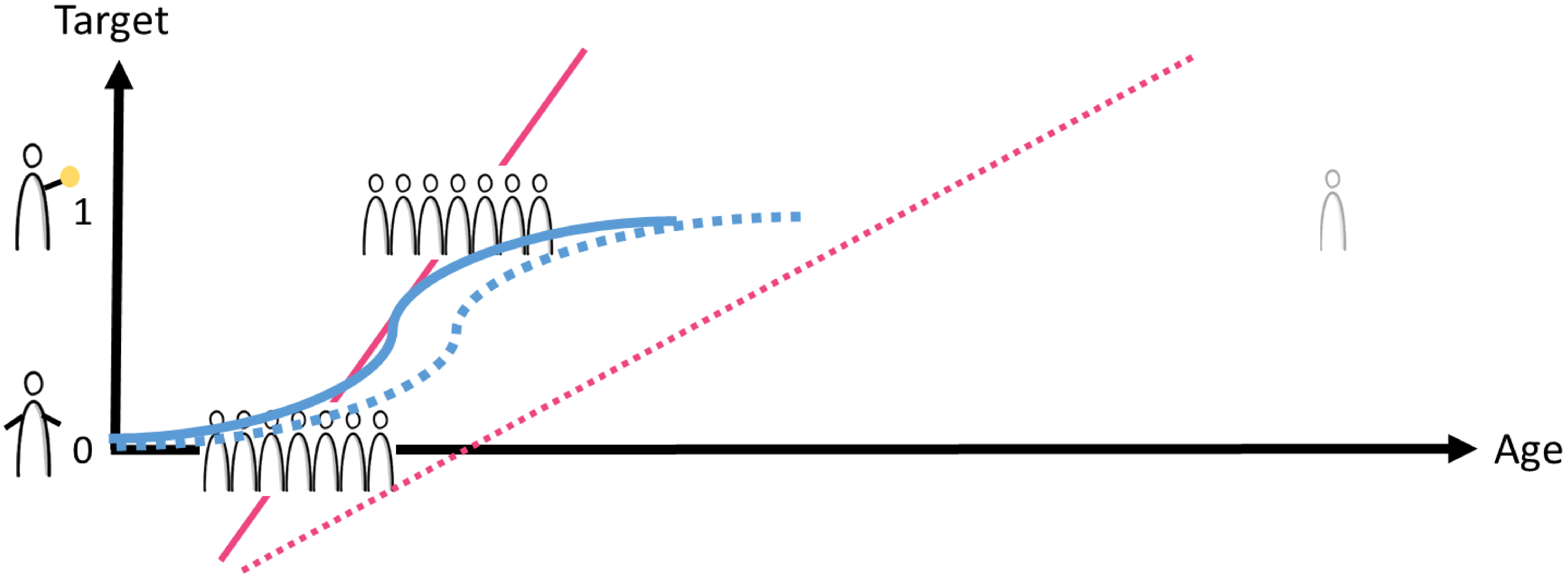
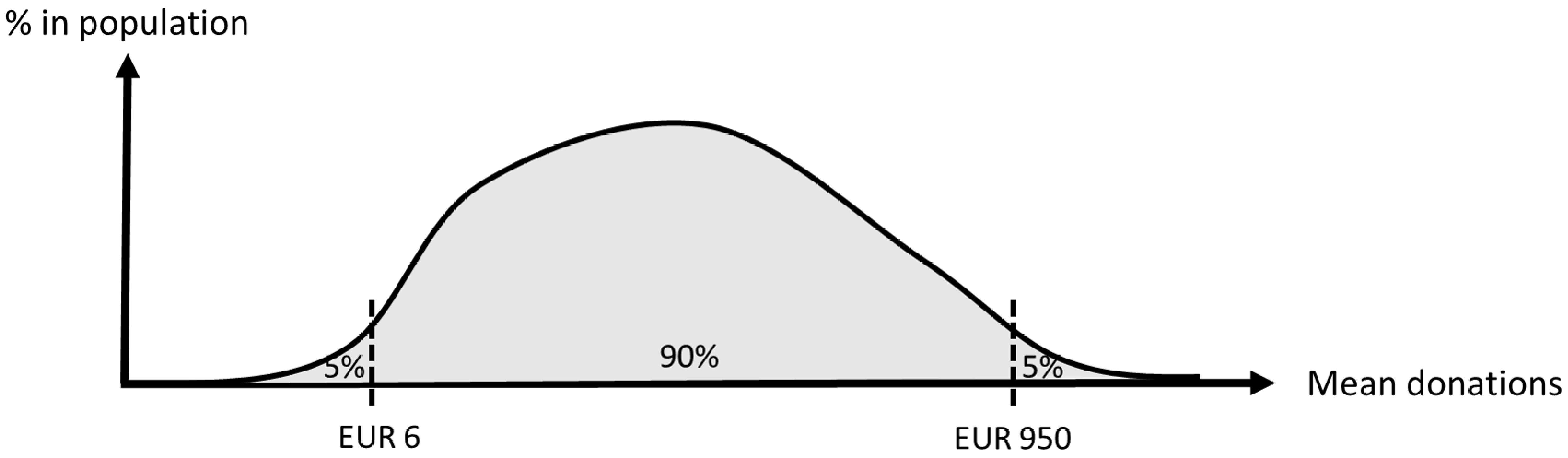
Influence of outliers on predictive models



Causes of outliers

- Human errors
- Measuring errors
- Truly extreme values
- ...

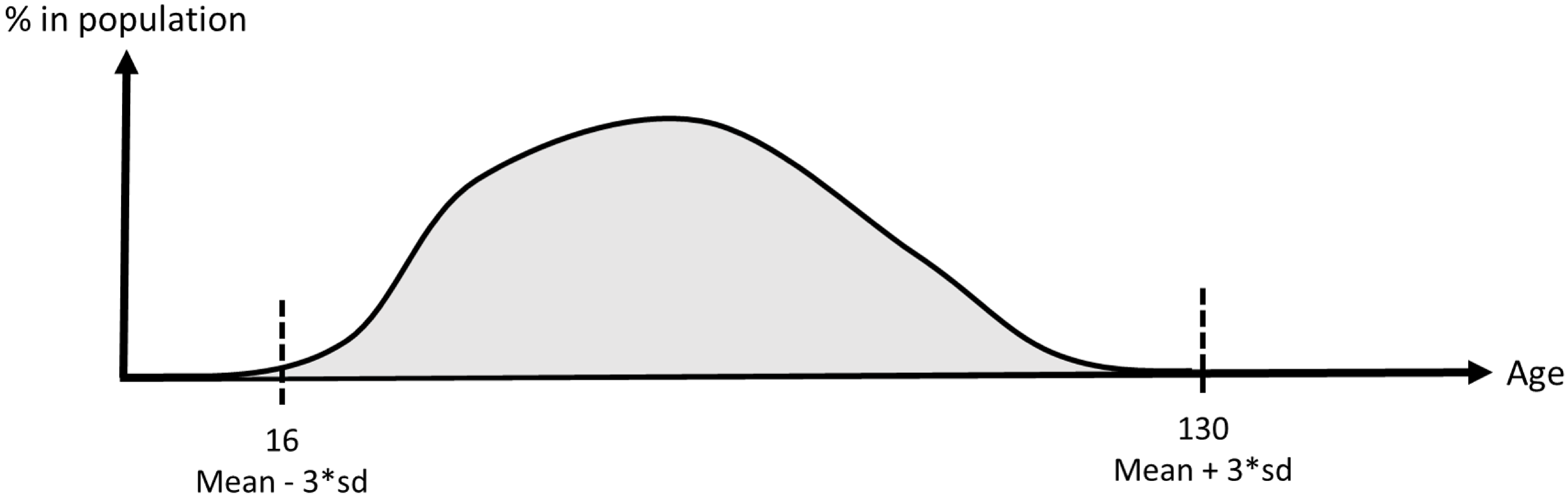
Winsorization concept



Winsorization in Python

```
from scipy.stats.mstats import winsorize
basetable["variable_winsorized"] =
     winsorize(
       basetable["variable"],
       limits = [0.05,0.01])
```

Standard deviation method concept



Standard deviation method in Python

```python
mean_age = basetable["age"].mean()
sd_age = basetable["age"].std()
lower_limit = mean_age - 3*sd_age
upper_limit = mean_age + 3*sd_age
basetable["age_no_outliers"] = pd.Series(
                                    [min(max(a,lower_limit), upper_limit)
                                     for a in basetable["age"]]
                                )
```

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Transformations

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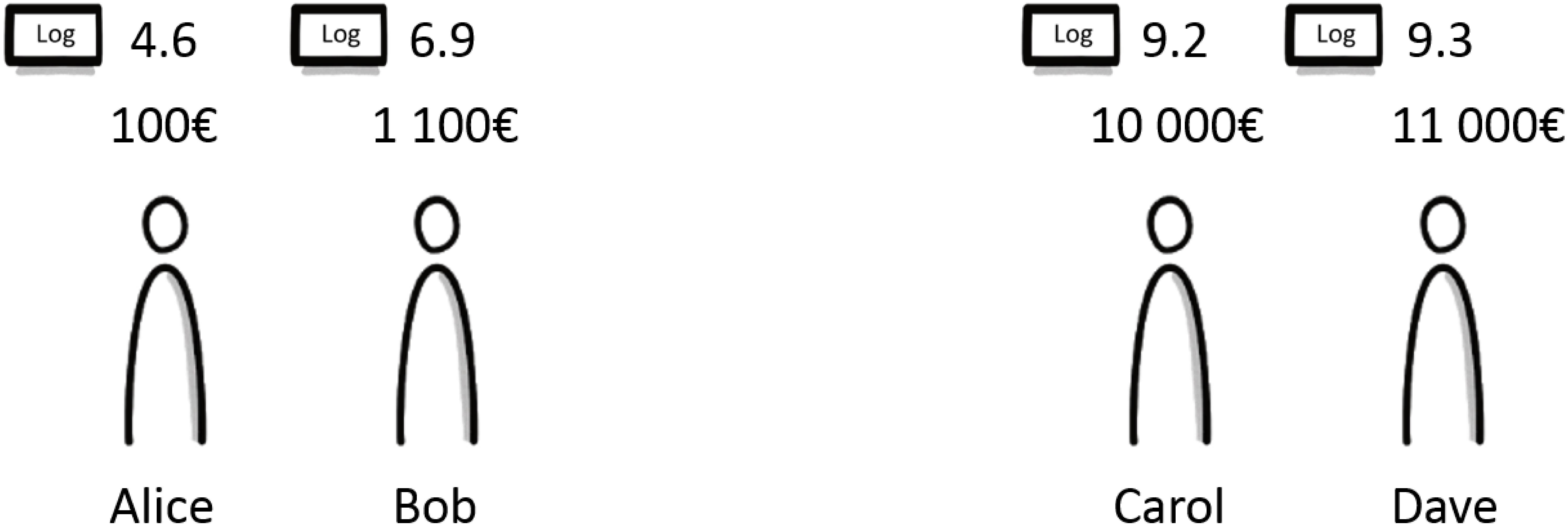
Motivation for transformations

100€ 1 100€ 10 000€ 11 000€

Alice Bob Carol Dave

Log transformation



Log 4.6

100€

Alice

Log 6.9

1 100€

Bob

Log 9.2

10 000€

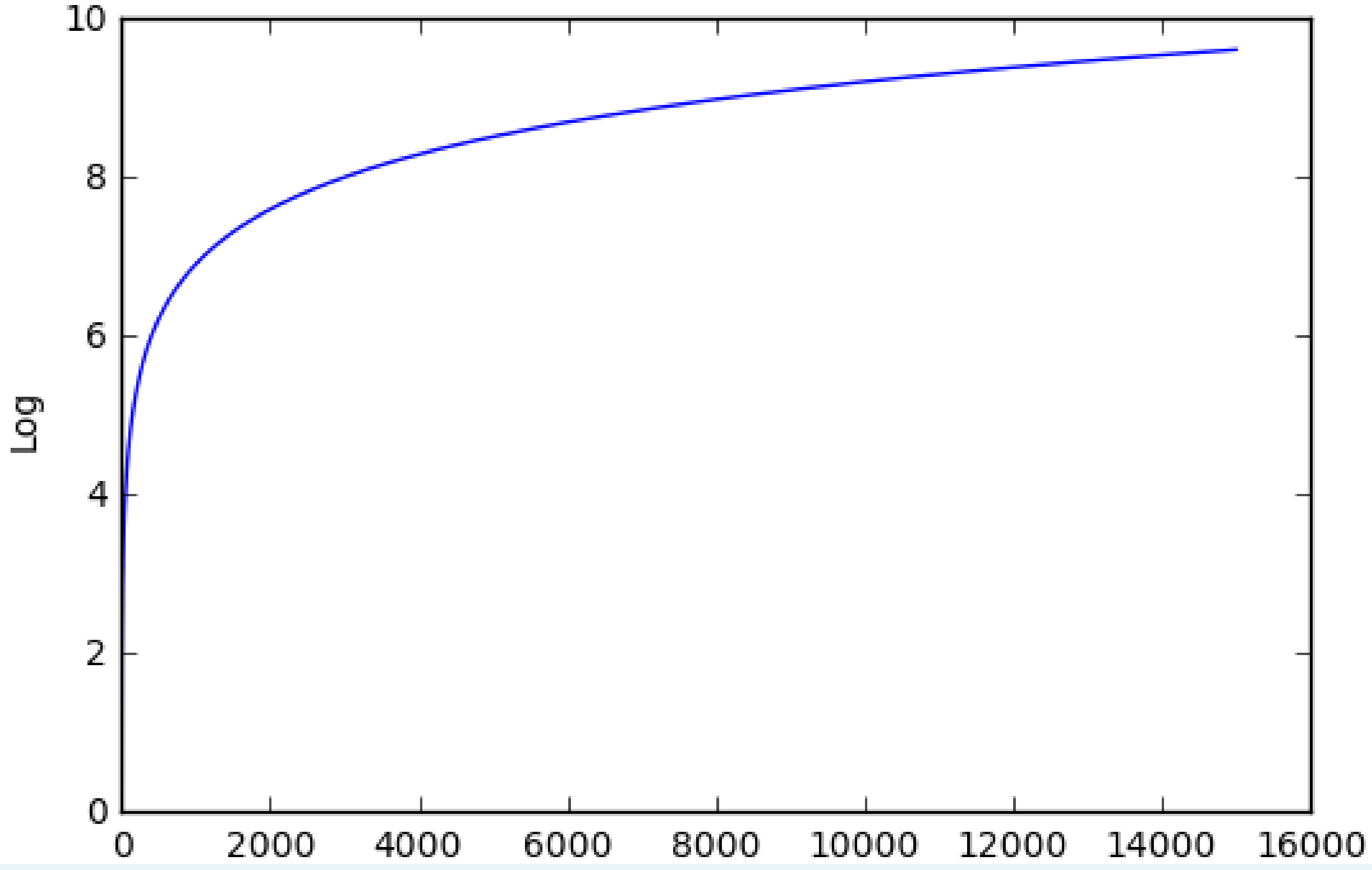
Carol

Log 9.3

11 000€

Dave

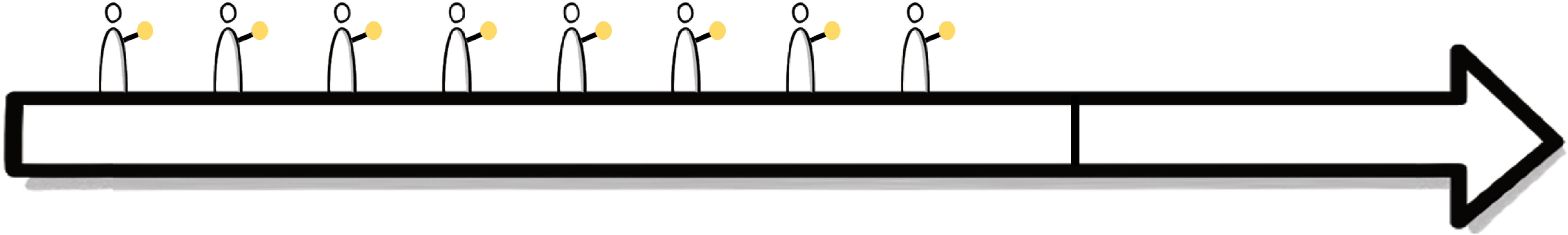
Log transformation



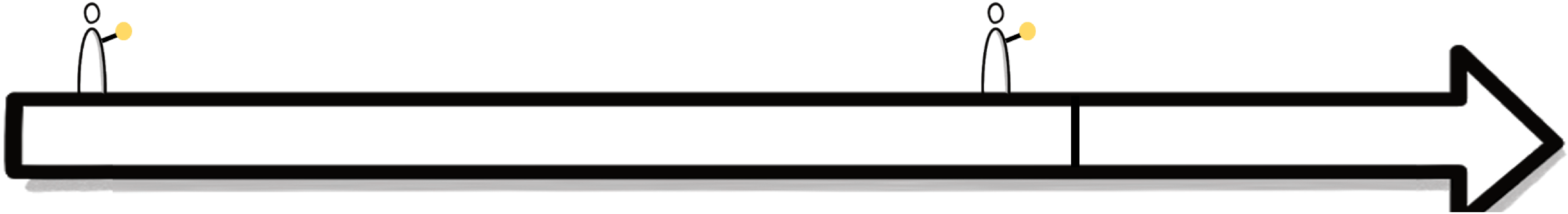
```python
import numpy as np
basetable["log_variable"] = np.log(basetable["variable"])
```

Interactions

Likely to donate soon



Unlikely to donate soon



Interactions in Python

```
basetable["number_donations_int_recency"] =
    basetable["number_donations"] * basetable["recency"]
```

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