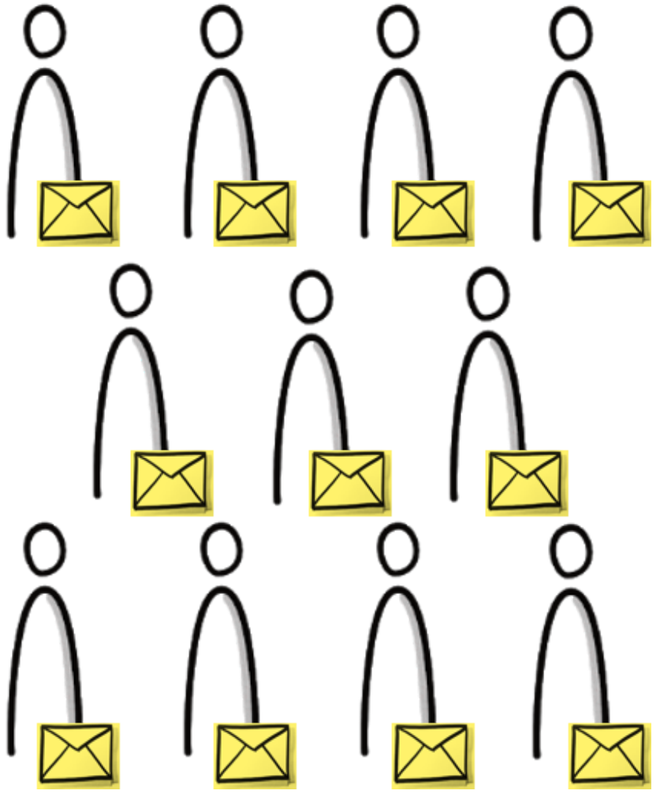
INTRODUCTION TO PREDICTIVE ANALYTICS IN PYTHON

Introduction and basetable structure

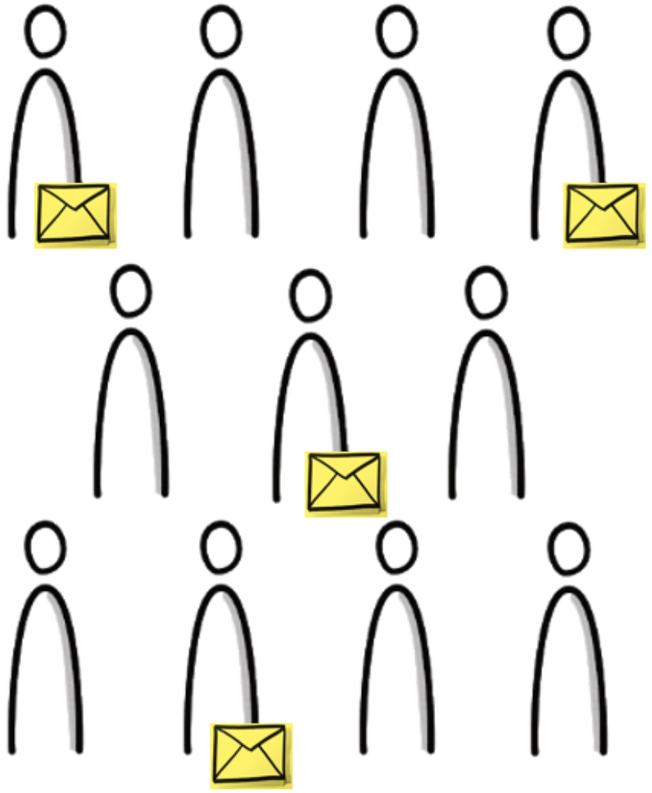
Nele Verbiest, Ph.D
Data Scientist
Python Predictions

Predictive analytics in fundraising

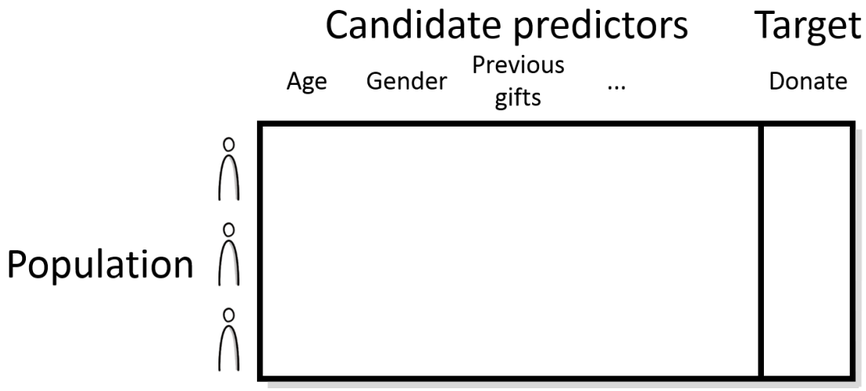
Address all donors



Address donors most likely to donate



The analytical basetable

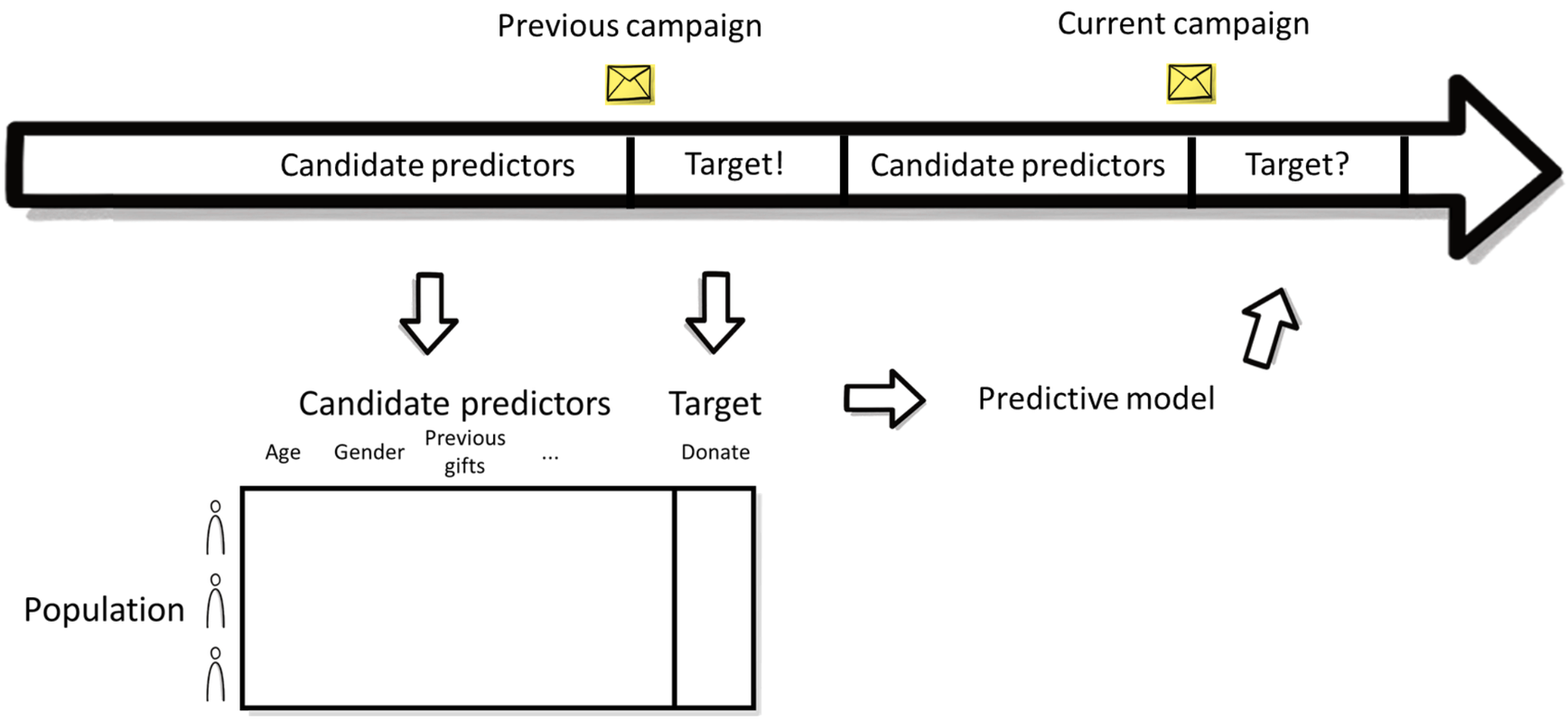



```
import pandas as pd
basetable = pd.DataFrame("import_basetable.csv")

population_size = len(basetable)

targets = sum(basetable["Target"])
```

The timeline



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Let's practice!

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Logistic regression

Nele Verbiest, Ph.D
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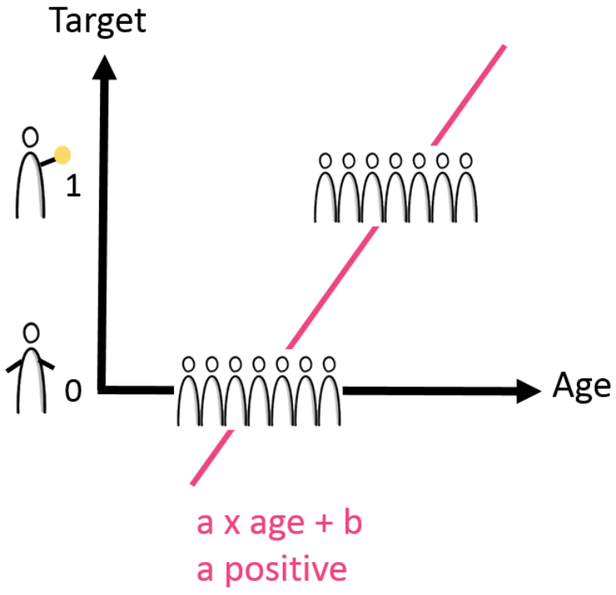
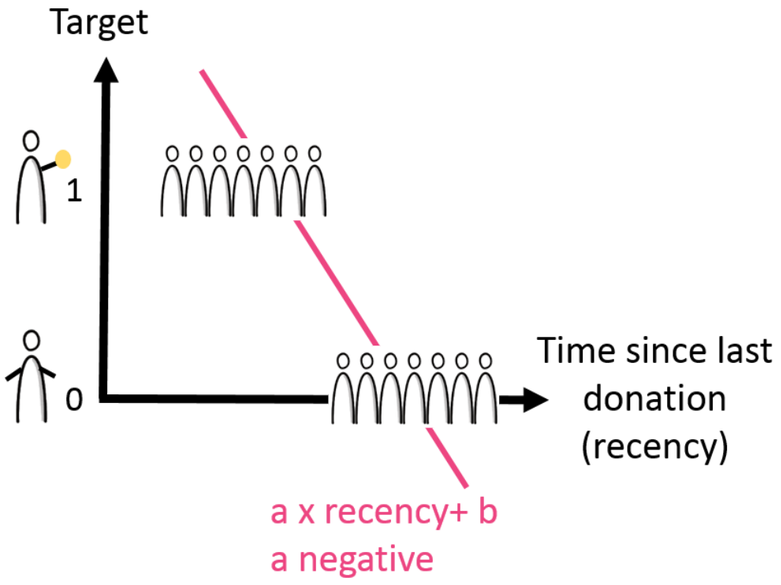
Logistic regression: intuition

Older people are more likely to donate

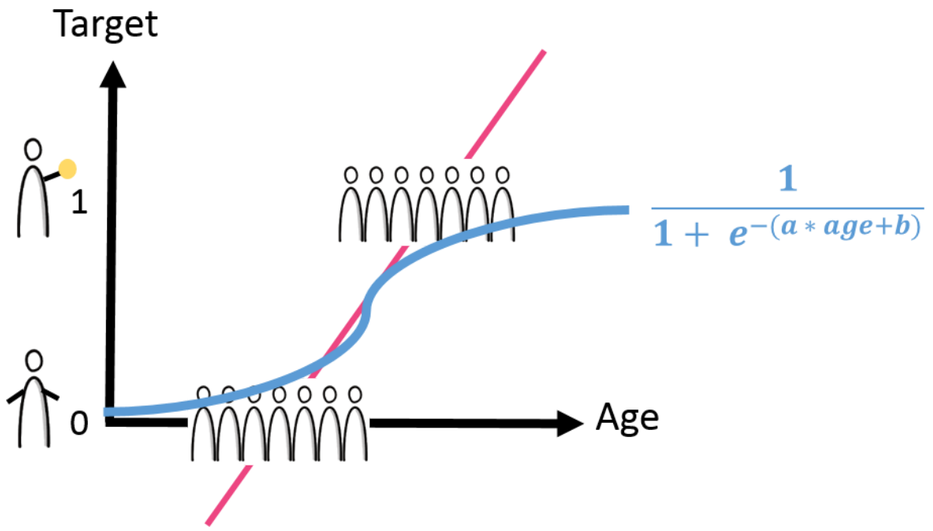


People who donated long time ago are less likely to donate



Logistic regression: the logit function

- Output of $a * age + b$ is a real number
- We want to predict a 0 or a 1
- Logit function transforms $a * age + b$ to a probability



Logistic regression in Python

```
from sklearn import linear_model

logreg = linear_model.LogisticRegression()

X = basetable[["age"]]

y = basetable[["target"]]

logreg.fit(X,y)

print(logreg.coef_)

[[ 0.02449202]]

print(logreg.intercept_)

[-4.3299131]
```

Multivariate logistic regression

Univariate: $ax + b$

Multivariate: $a_1x_1 + a_2x_2 + ... + a_nx_n + b$

```
X = basetable[["age","max_gift","income_low"]]
y = basetable[["target"]]
logreg.fit(X,y)
print(logreg.coef_)
[[ 0.0243308   0.03906065 -0.76793773]]
print(logreg.intercept_)
[-8.80643545]
```

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Using the logistic regression model

Nele Verbiest, Ph.D
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The logistic regression function

```
0.545 * gender_F
+ 0.021 * age
-0.001 * time_since_last_gift
-3.39
```

- Female (gender_F=1)
- age 72
- 120 days since last gift

```
0.545 * 1
+ 0.021 * 72
-0.001 * 120
-3.39
= -1.45
```

$$\frac{1}{1+e^{-(-1.45)}} = 0.19$$

Making predictions in Python

- Female (gender_F=1)
- Age 72
- 120 days since last gift

```
logreg.predict_proba([1, 72, 120])

array([[ 0.8204144,  0.1795856]])
```

Making predictions in Python

```
new_data = current_data[["gender_F","age","time_since_last_gift"]]

predictions = logreg.predict_proba(new_data)
```

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