FOUNDATIONS OF PREDICTIVE ANALYTICS IN PYTHON (PART 1)

Introduction and basetable structure

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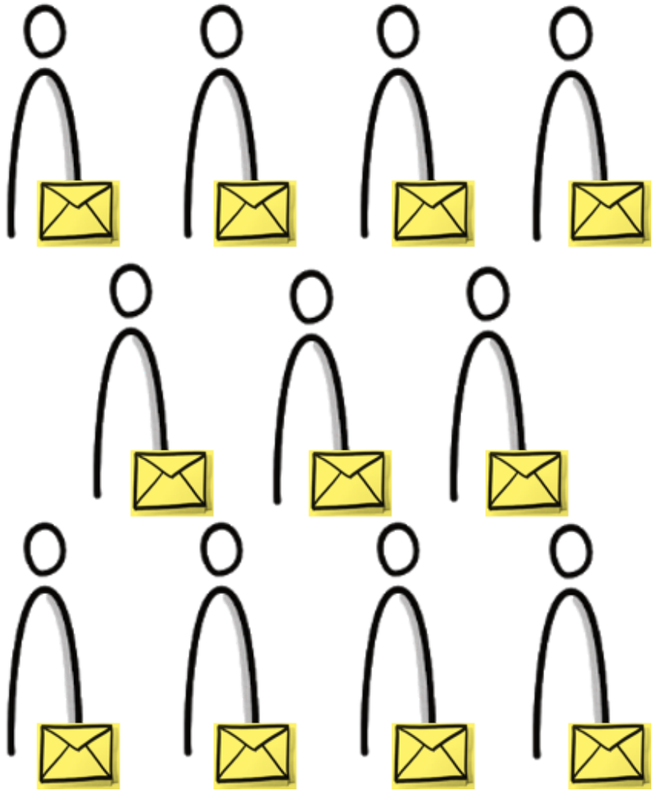
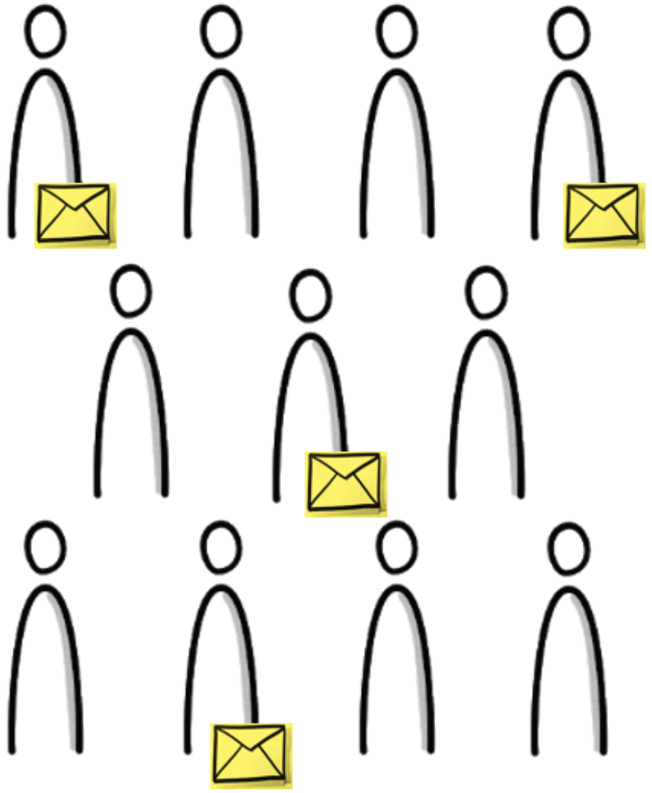
Data Scientist
Python Predictions

Predictive analytics in fundraising

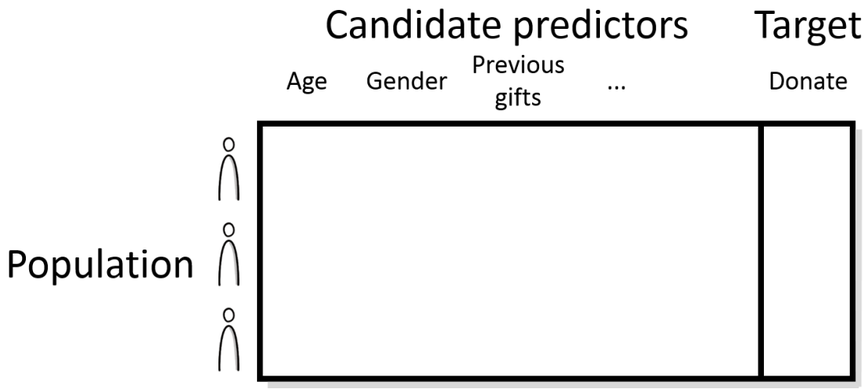
Address all donors



Address donors most likely to donate



The analytical basetable

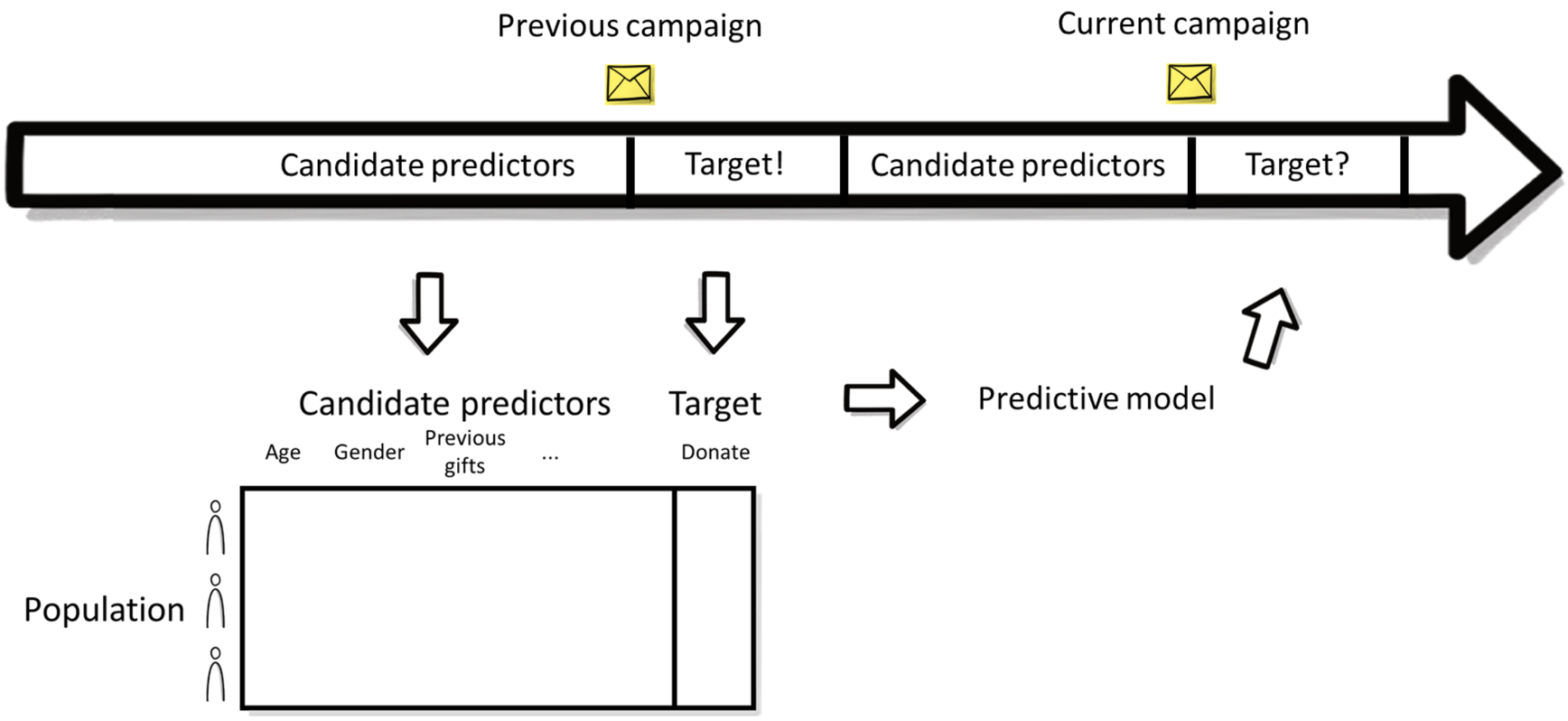



```
import pandas as pd
basetable = pd.DataFrame("import_basetable.csv")

population_size = len(basetable)

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

The timeline



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Let's practice!

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Logistic regression

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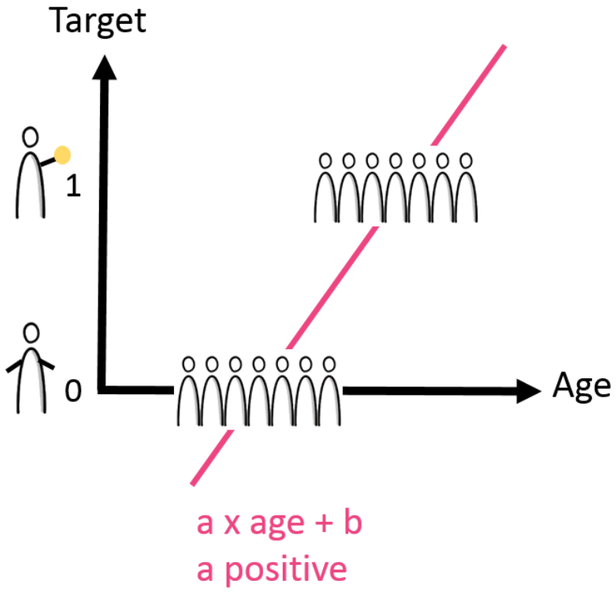
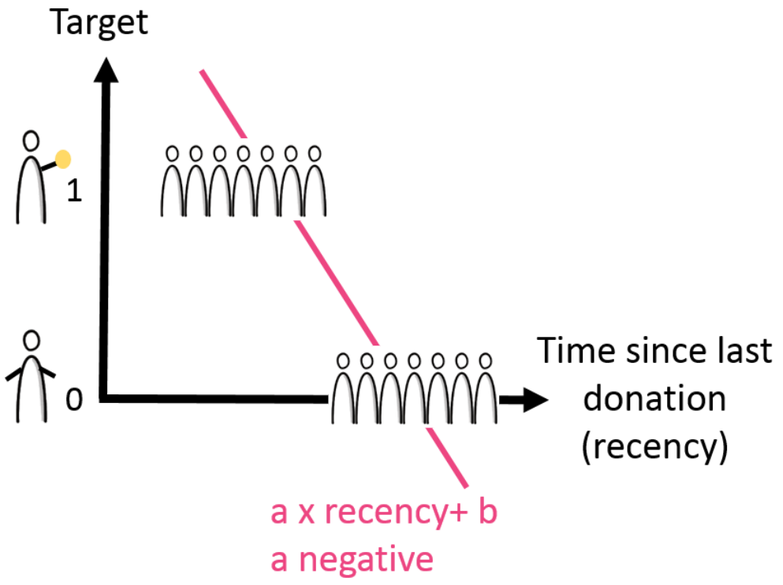
Logistic regression: intuition

Older people are more likely to donate

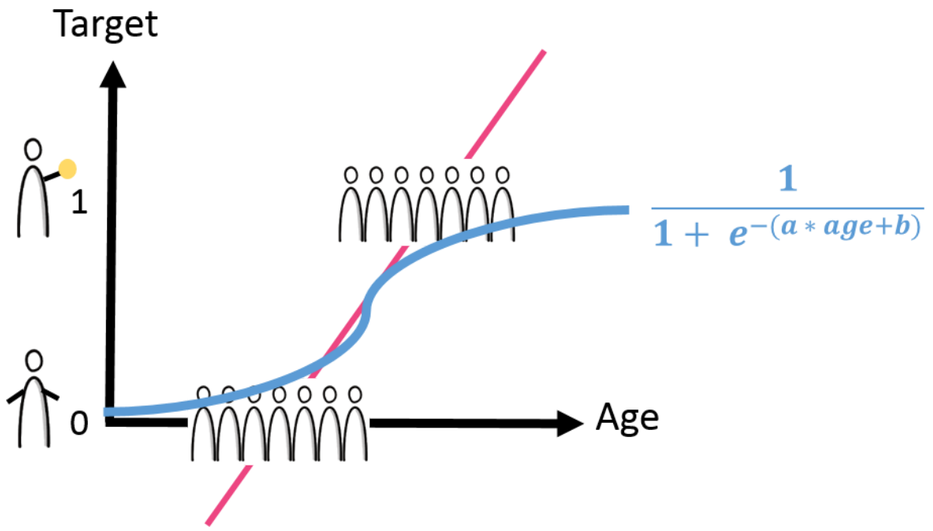


People who donated long time ago are less likely to donate



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

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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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