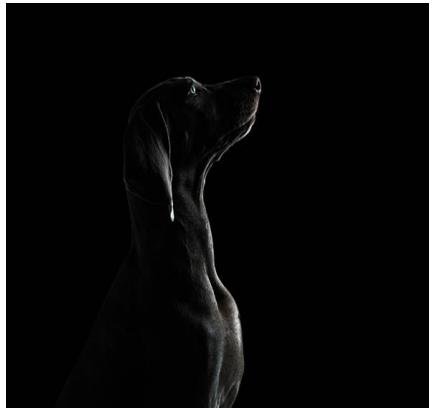
# 2

# Элементы машинного обучения

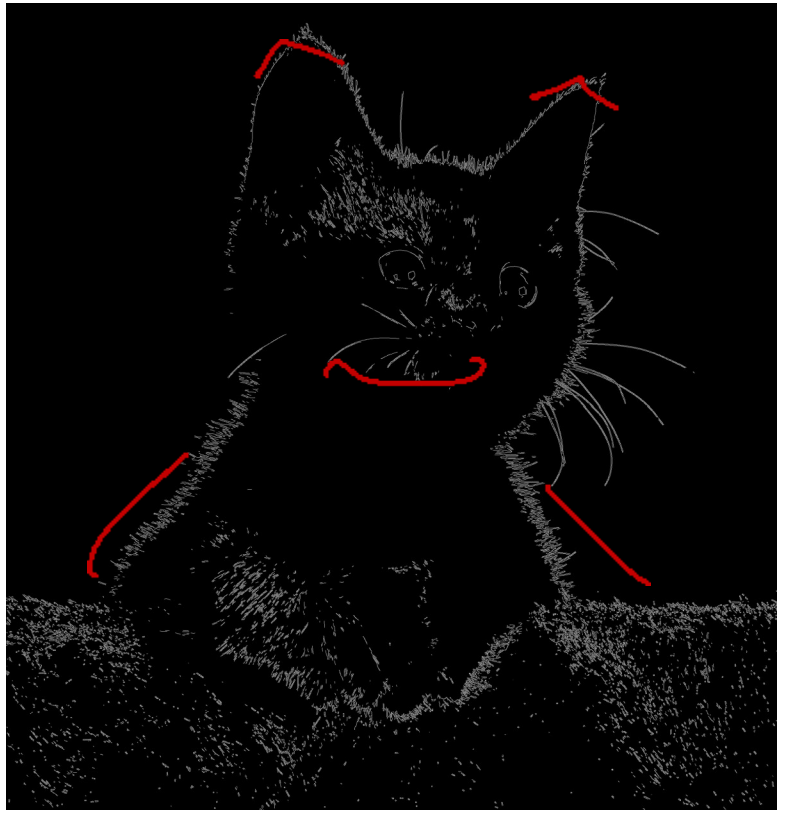
# Кошечки или собачки





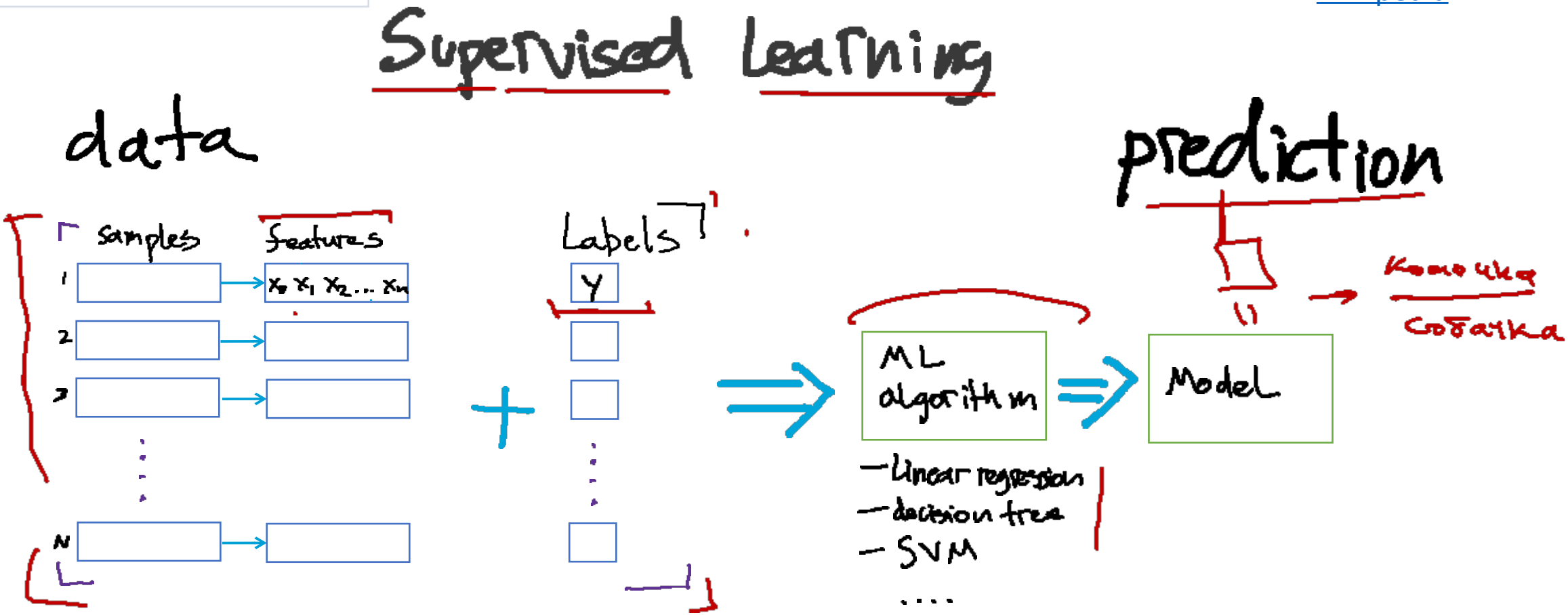
# Алгоритм?



# Машинное обучение
# Machine Learning

**Machine learning** is a field of computer science that gives computers the ability to learn without being explicitly programmed.[1]

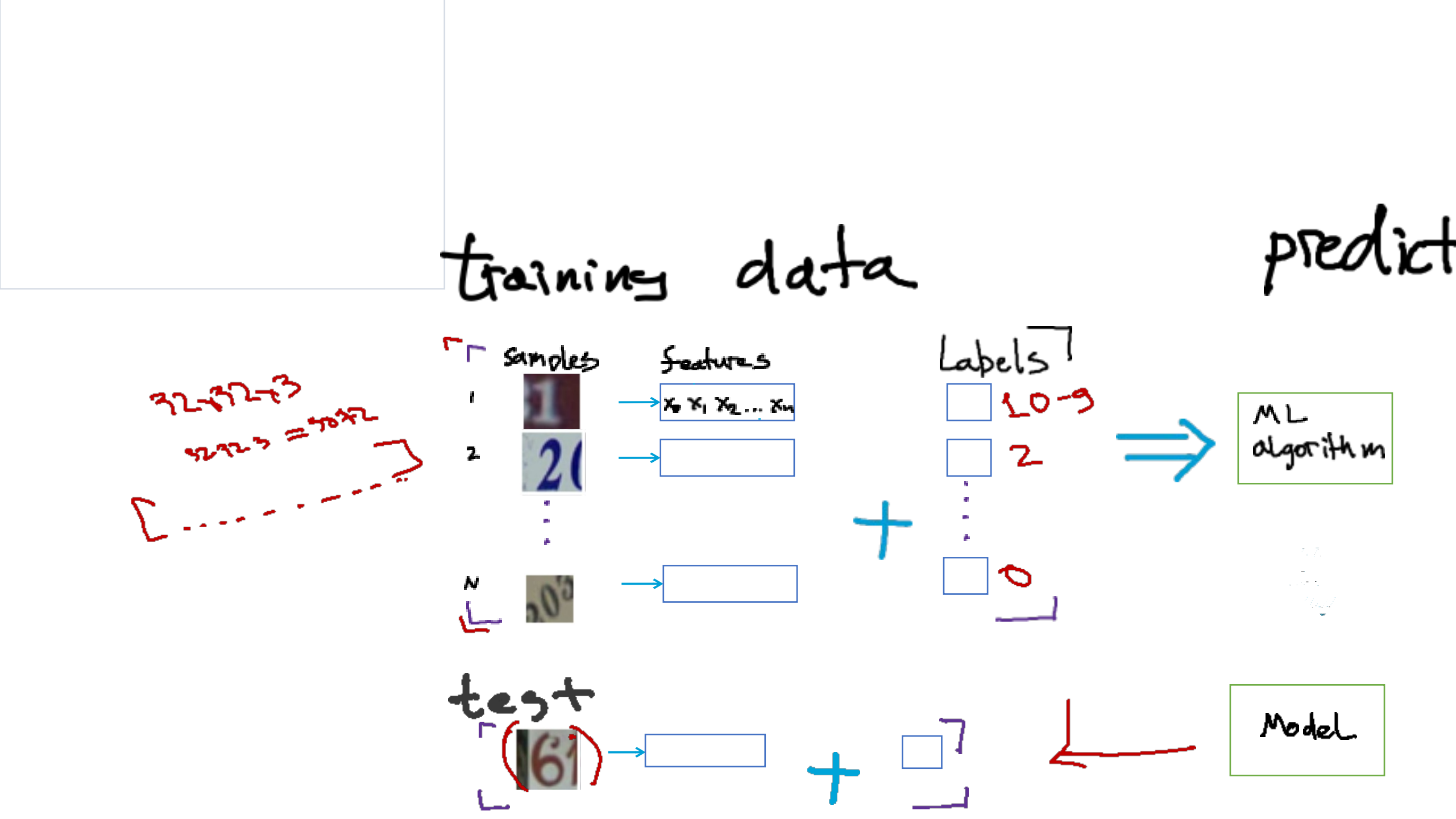
Wikipedia



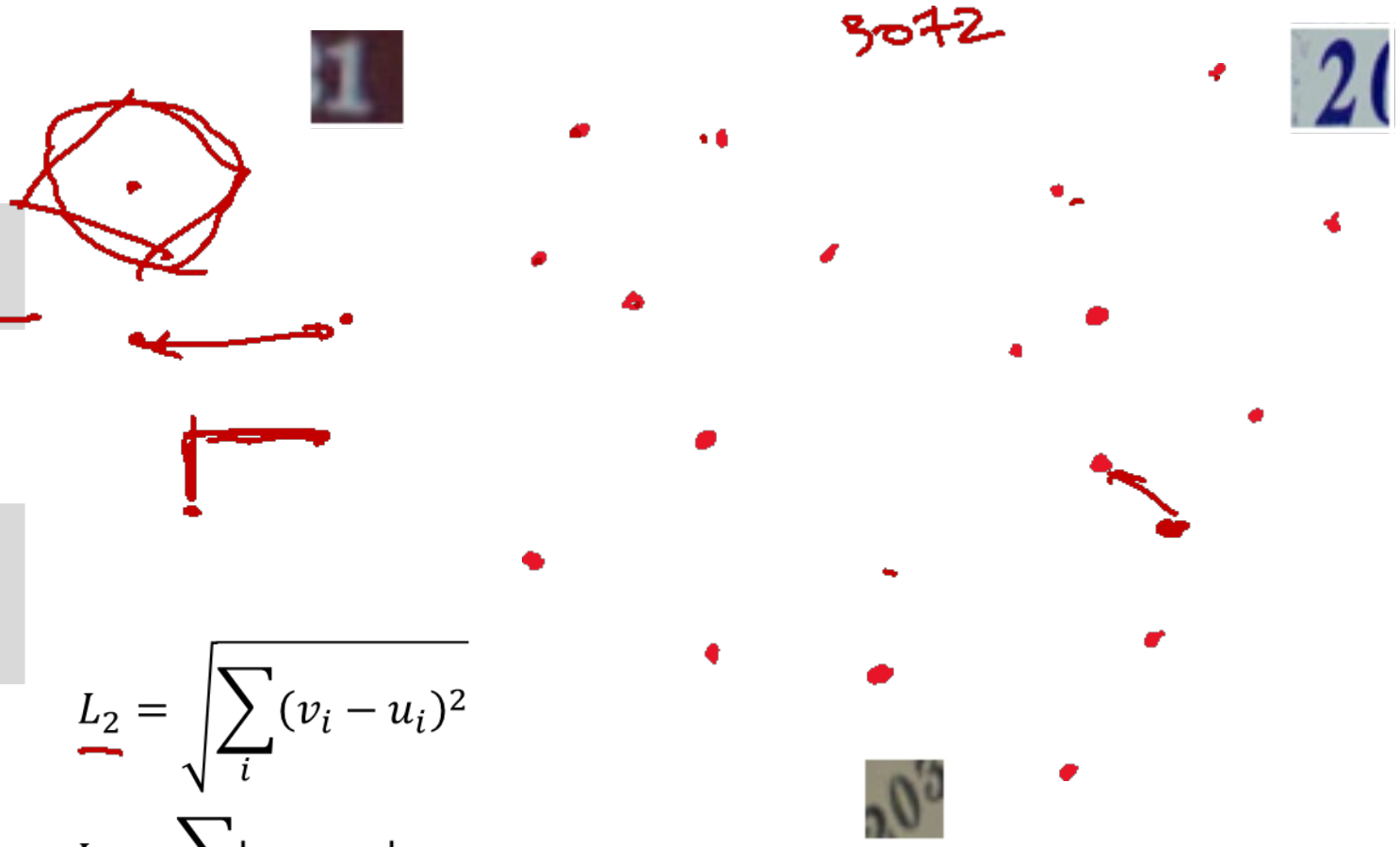
# Street View House Numbers

32x32 pixels
10 classes
~70000 train
~25000 test

http://ufldl.stanford.edu/housenumbers/


training data
predict
samples
features
Labels
1
2
N
1 0-9
2
0
ML algorithm
test
Model

# Метод ближайших соседей
# Nearest neighbor



```
Train:
    просто все запомнить
```

```
Predict:
    найти ближайший  и
выдать его класс
```

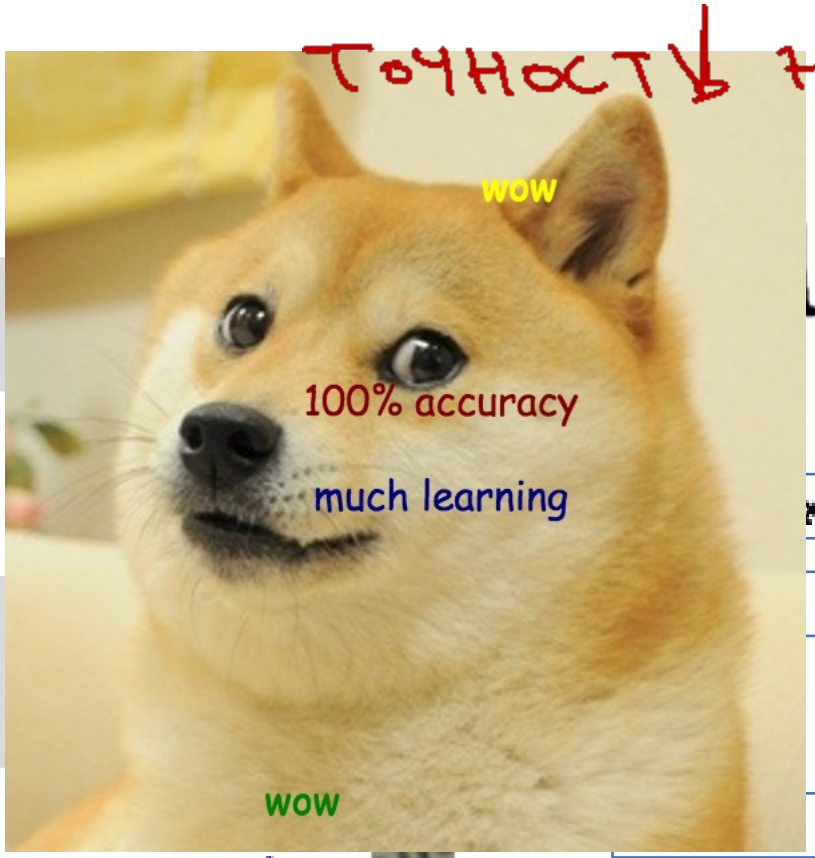
$$L_2 = \sqrt{\sum_i (v_i - u_i)^2}$$

$$L_1 = \sum_i |v_i - u_i|$$

# Точность на тренировочных vs тестовых данных

```
Train:
    просто все запомнить
```

```
Predict:
    найти ближайший  и
выдать его класс
```

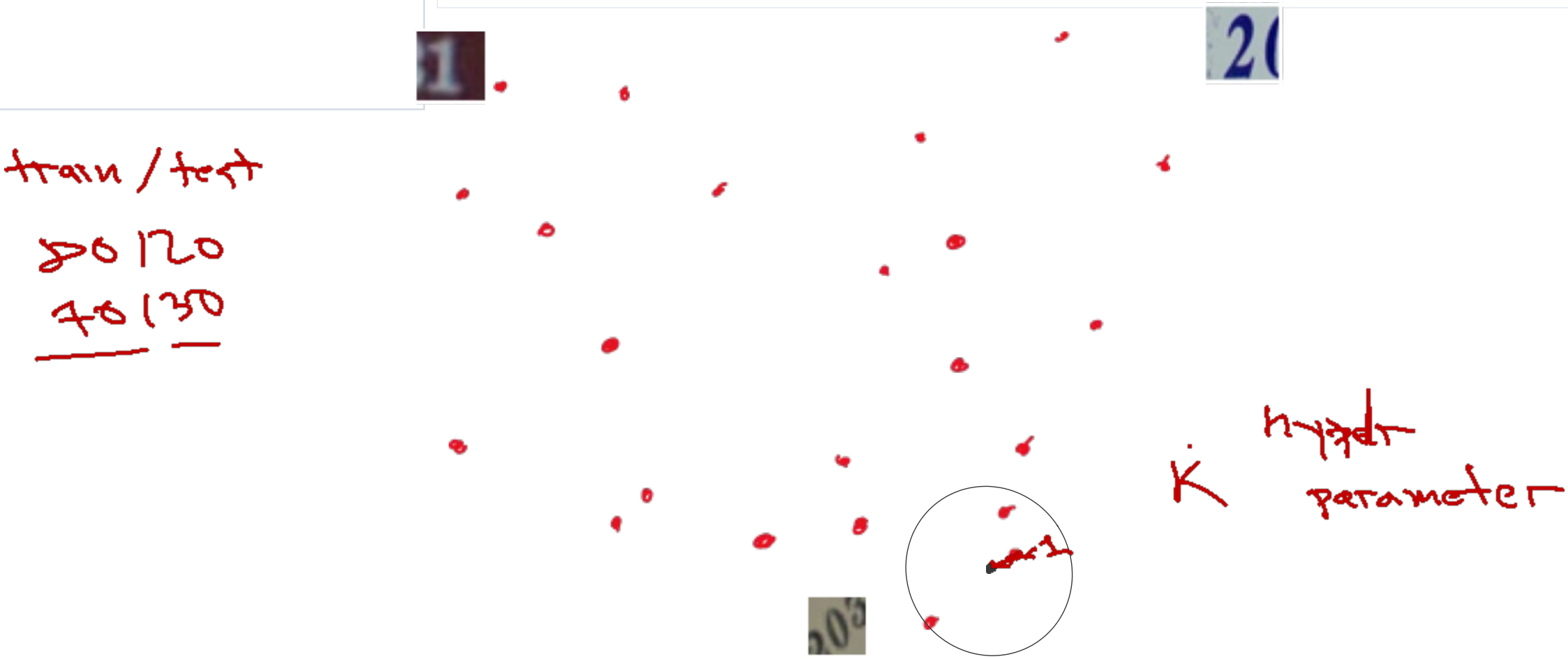



Точность на тренировочных данных?

ata

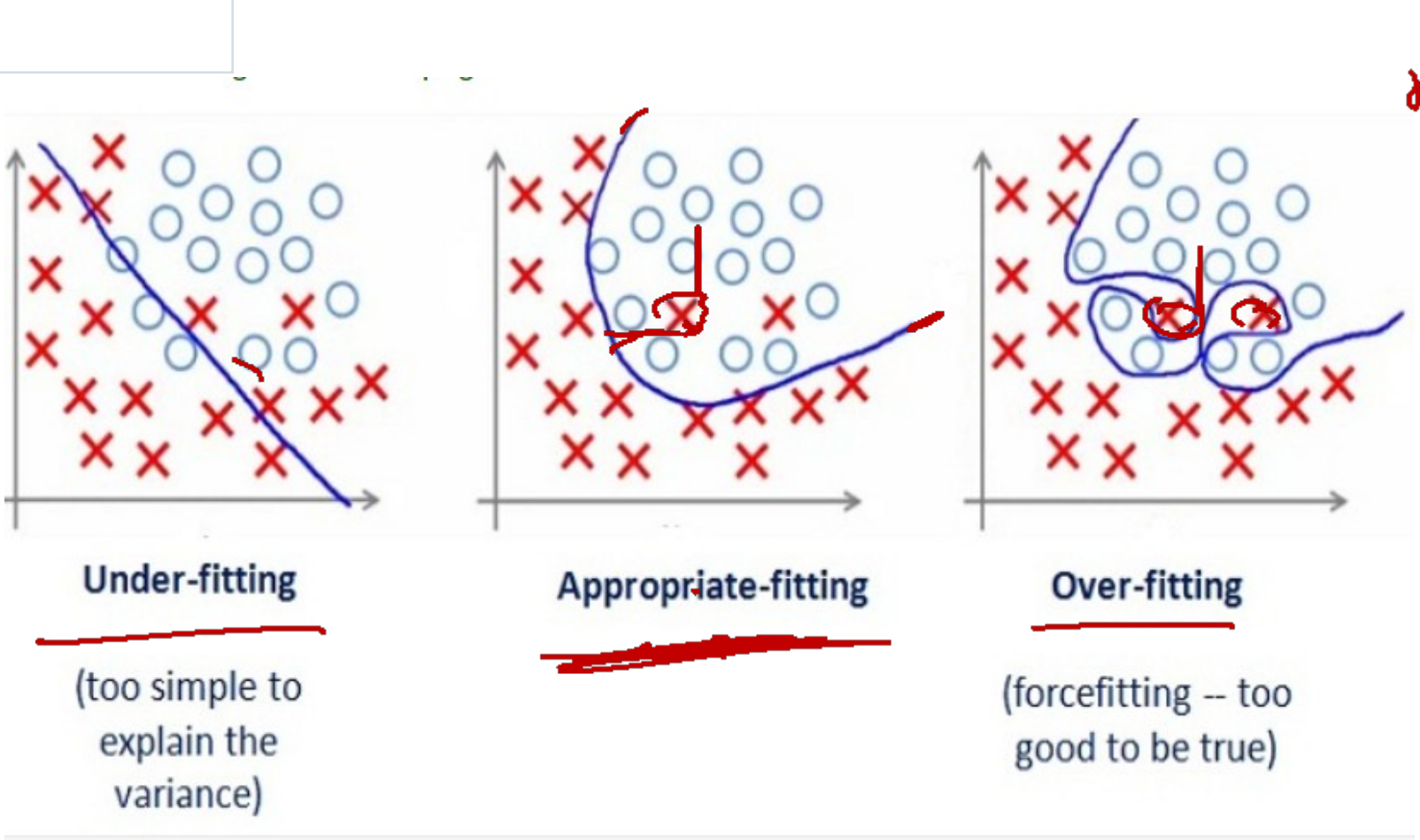
Labels

# Метод k-ближайших соседей
# K-nearest neighbors

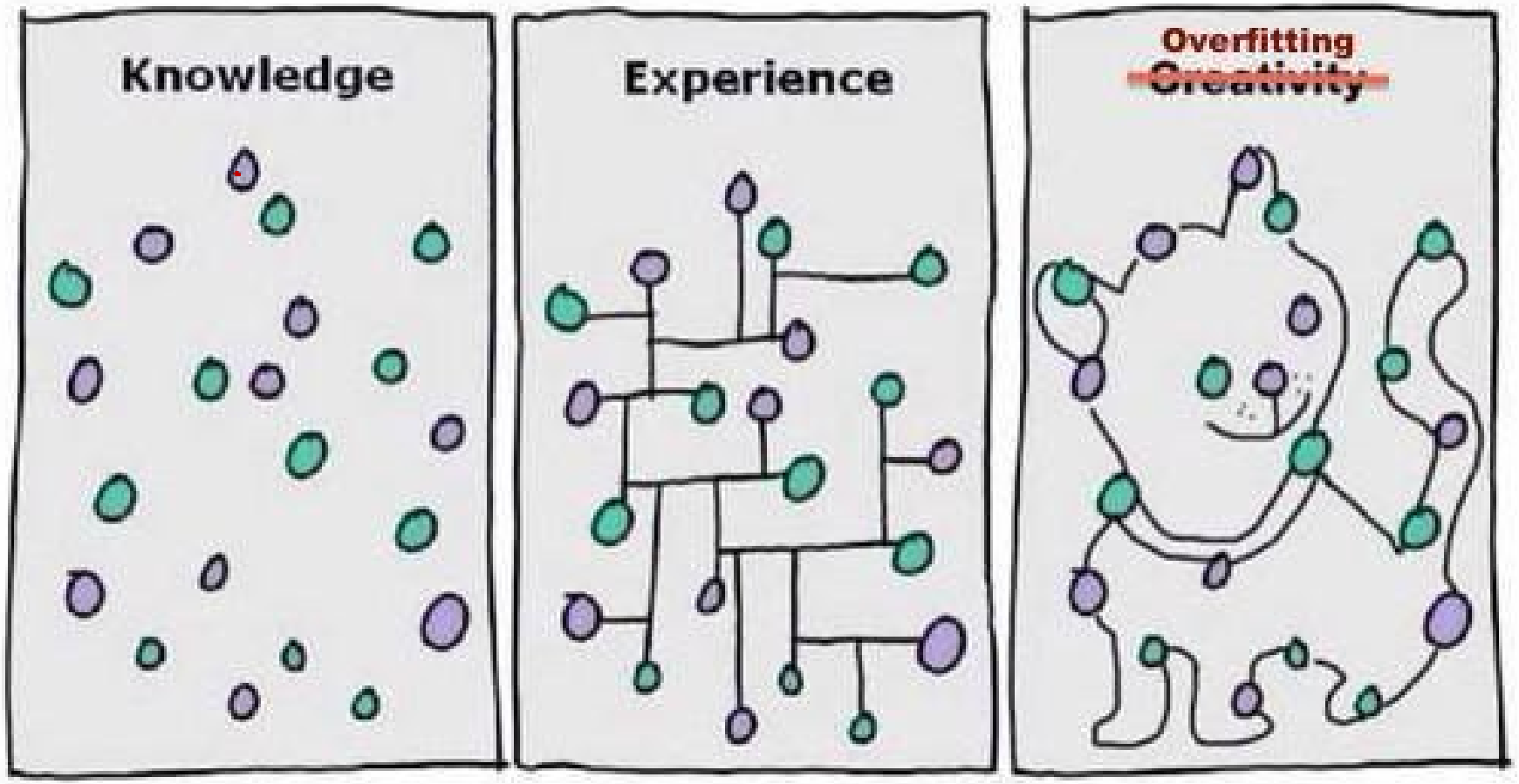


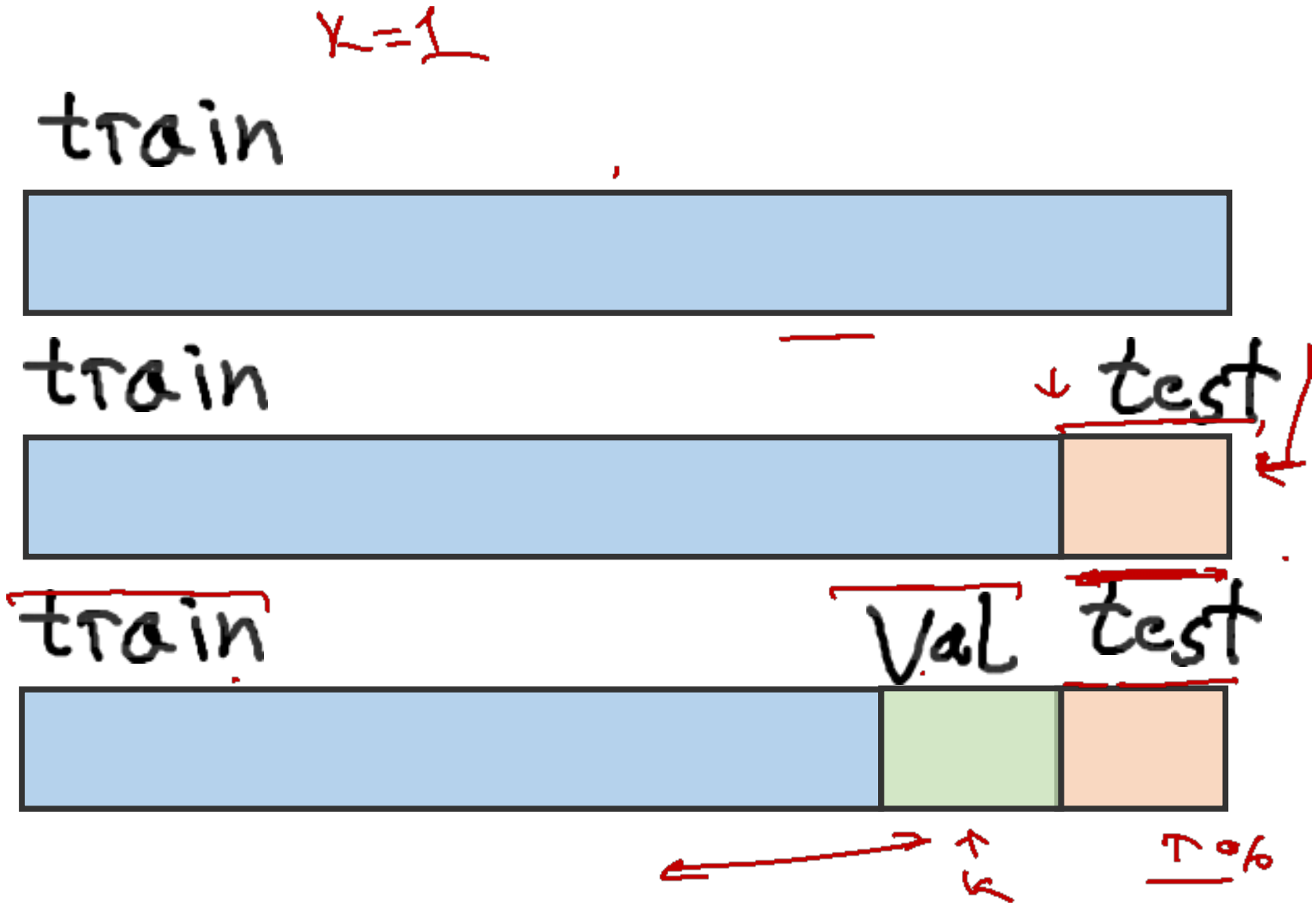

Как выбрать K?

# Переобучение и недообучение
# Overfitting vs underfitting

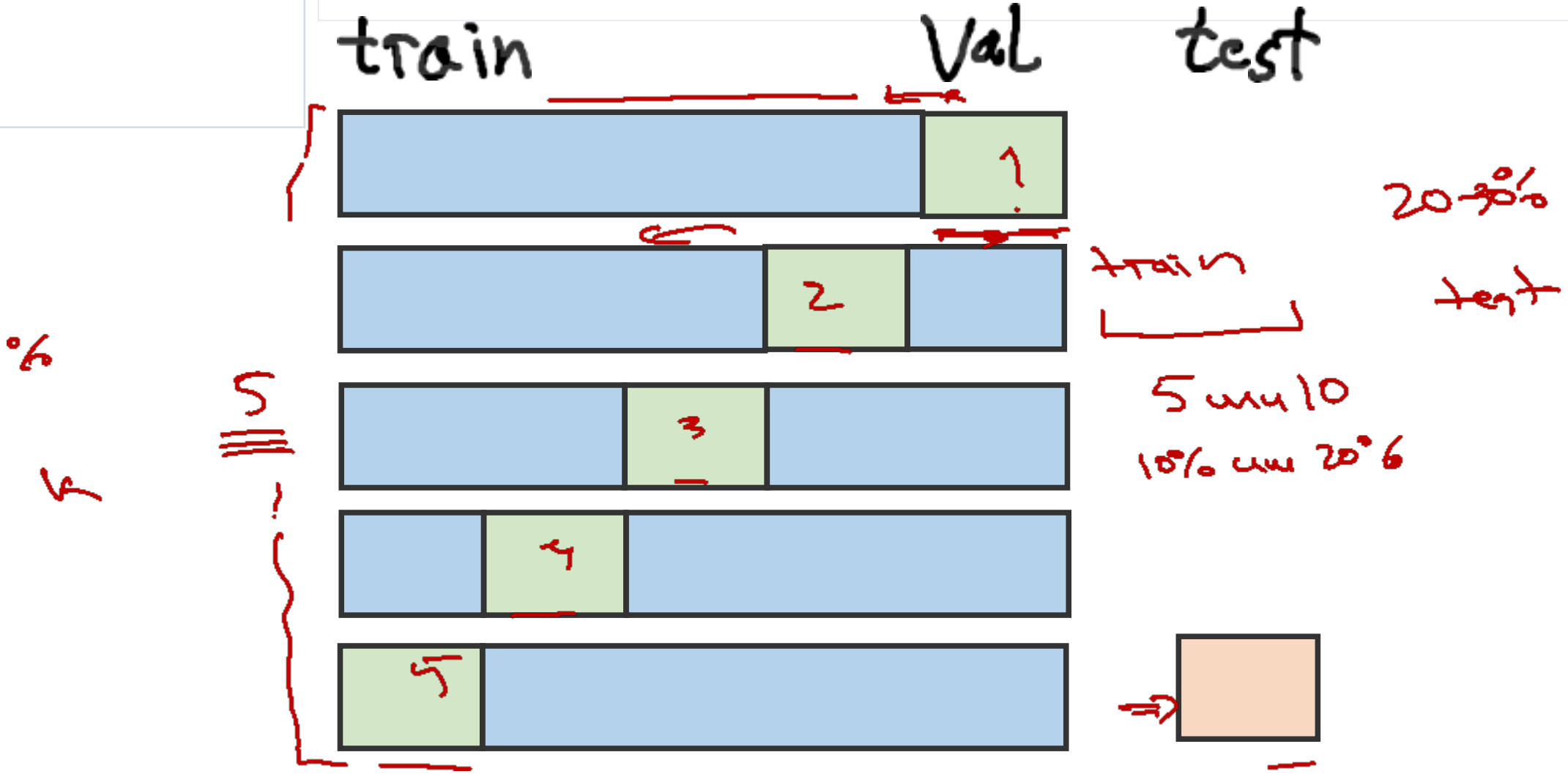



What is underfitting and overfitting in machine learning and how to deal with it


Knowledge
Experience
Overfitting
Creativity


K=1
train
train
test
train
Val
test
T%

# Кросс-валидация
# Cross-validation



# Как сравнивать?

Бинарная классификация

Binary classification

 vs 

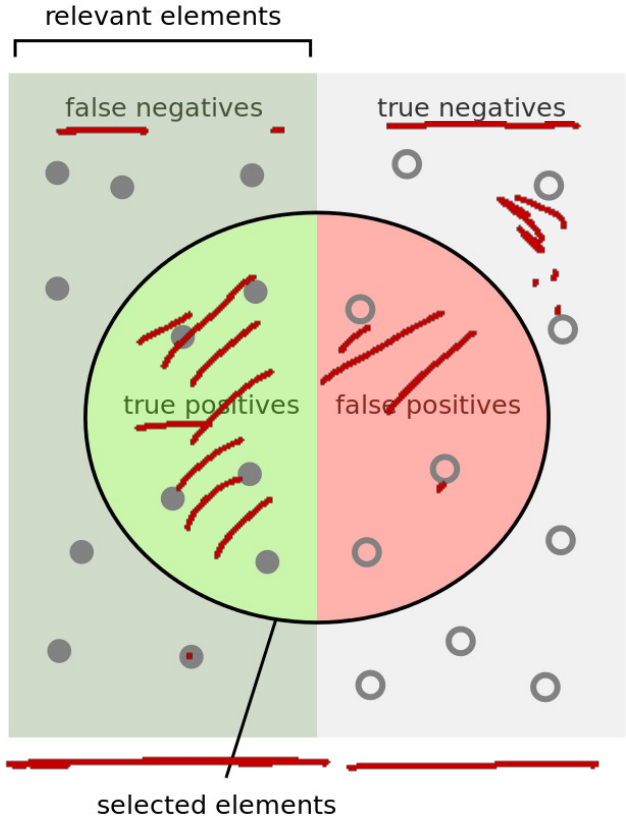
Точность

$$Accuracy \equiv \frac{correct}{total}$$

$$Precision = \frac{TP}{TP + FP}$$

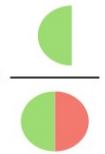
$$Recall = \frac{TP}{TP + FN}$$

$$F1 = \frac{2}{\frac{1}{precision} + \frac{1}{recall}} = \frac{2 * (precision * recall)}{precision + recall}$$




How many selected items are relevant?

Precision =



How many relevant items are selected?

Recall =

[Wikipedia]

# Как сравнивать?

Бинарная классификация

Binary classification

vs

Точность

$$Accuracy \equiv \frac{correct}{total}$$

$$Precision = \frac{TP}{TP + FP}$$

$$Recall = \frac{TP}{TP + FN}$$

$$F_1 = 2 * \frac{precision * recall}{precision + recall}$$

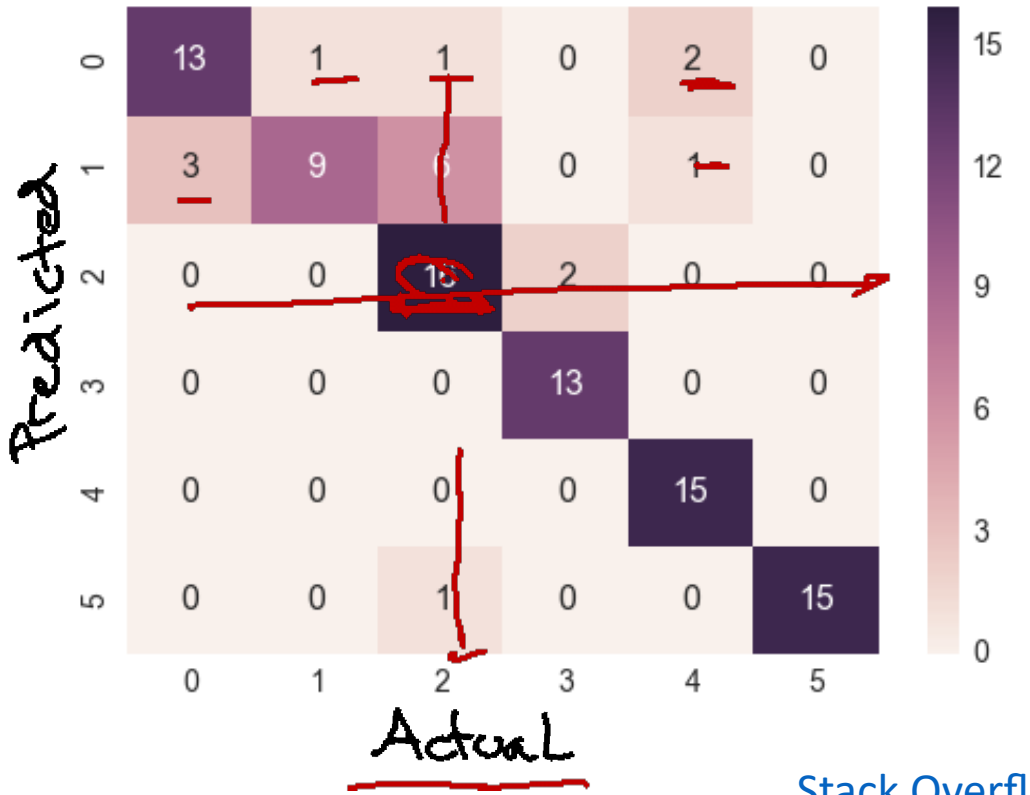
# Как сравнивать?

## Многоклассовая классификация
## Multi-class classification


Точность

$$Accuracy \equiv \frac{correct}{total}$$

confusion matrix




$$Precision_c = \frac{A_{c,c}}{\sum_{i=1}^{n} A_{c,i}}$$

$$Recall_c = \frac{A_{c,c}}{\sum_{i=1}^{n} A_{i,c}}$$

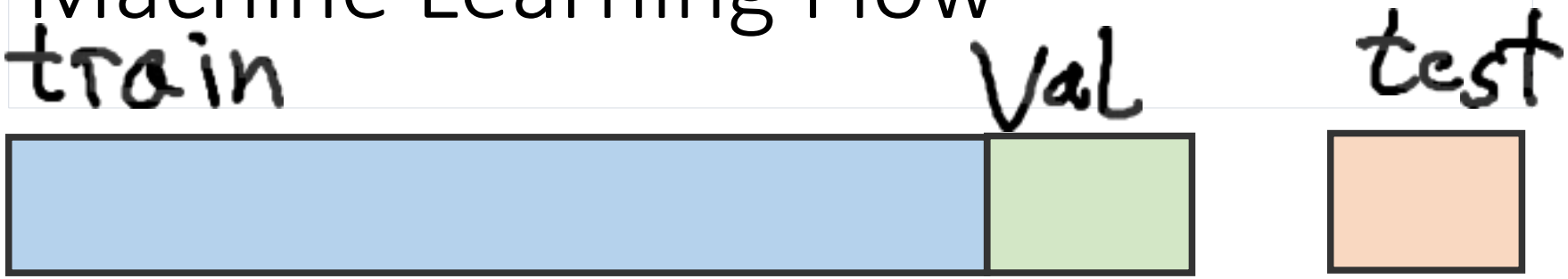
$$Precision = \frac{\sum_{c=1}^{n} P_c}{n}$$

$$Recall = \frac{\sum_{c=1}^{n} R_c}{n}$$

Stack Overflow


MAKE GIFS AT GIFSOUP.COM

# Machine Learning Flow




Кстати вот он про это подробнее:
[Nuts and Bolts of Applying Deep Learning]


Ошибка на train

большая → underfitting
- Более мощную модель
- Больше ресурсов для тренировки
- Другой подход

маленькая ↓

Ошибка на val

большая → overfitting
- Больше данных
- Больше регуляризации
- Другой подход

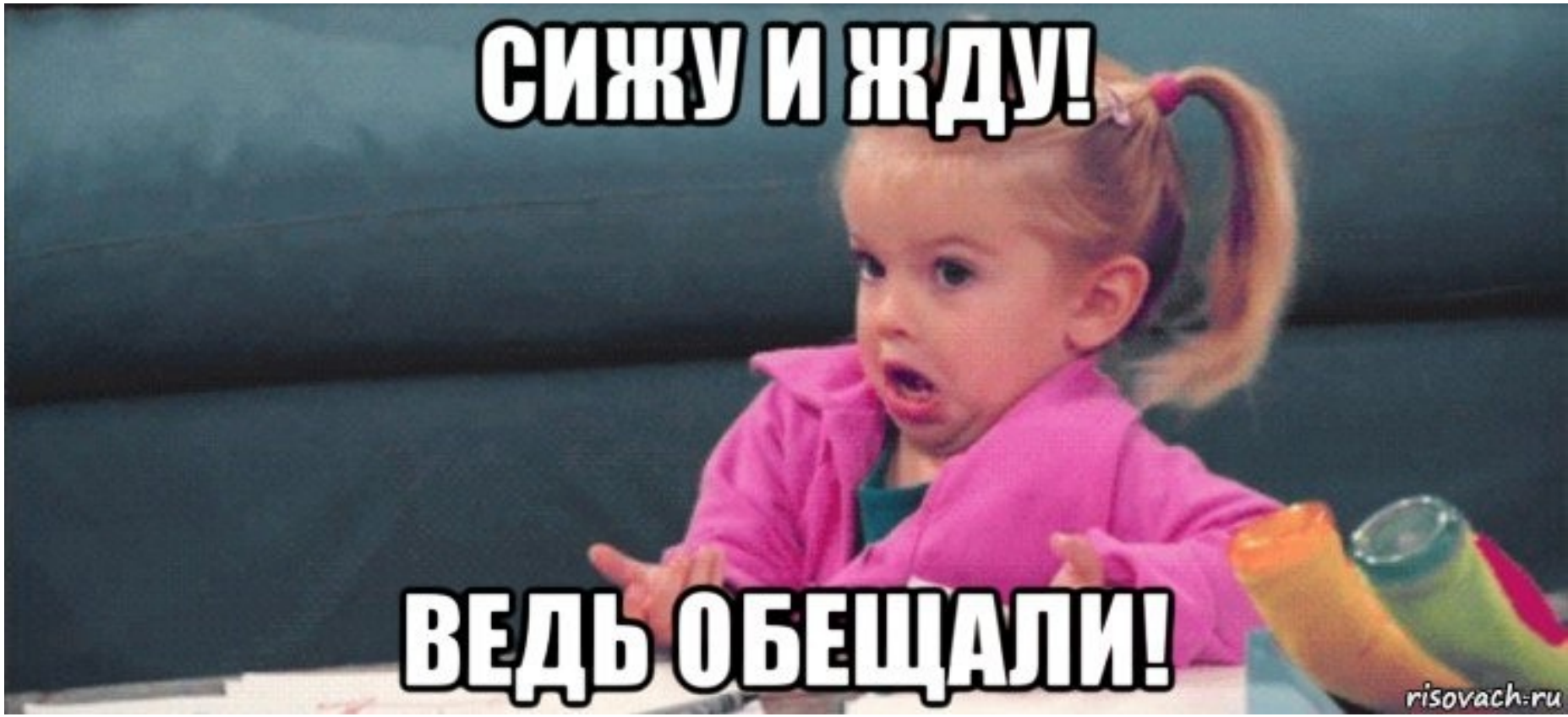
маленькая ↓

Ошибка на test

большая →
- Отличаются train и test
- Больше данных, таких как test

← маленькая

В следующий раз уже будет про нейросети

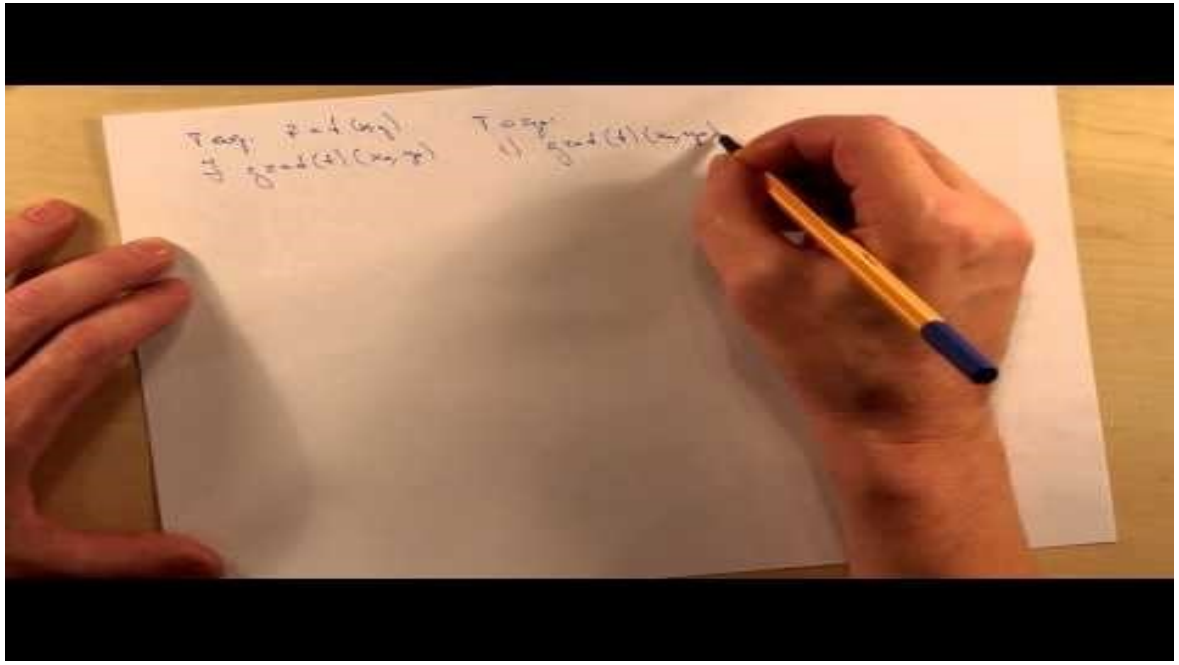


# Домашнее задание!

Повторить производную сложной функции (chain rule)

ч Градиент

Link



Link