Practical Introduction to Machine Learning

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Scope

Objectives

- Guide participants through the steps required to solve real-world problems using machine learning
- Provide hands-on experience working with real-world data sets and popular ML tools

Focus

- Not about defining the field of ML or providing a deep understanding of the mathematical foundation of ML algorithms
- Focuses on guiding participants through the steps required to solve real-world problems using machine learning

Overview

Data preprocessing

Bag-of-Words:

- *A method of representing text data based on the frequency of occurrence words within documents*

Standardization

Model selection and evaluation

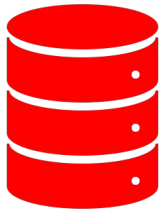
Support Vector Machines

Optimization

Finding the best performing model:

- Grid search

Problem definition



Data

MOROCO –The Moldavian and Romanian Dialectal Corpus

Text collected from the news domain

The samples belong to one of the following six topics: (0) culture, (1) finance, (2) politics, (3) science, (4) sports, (5) tech

Process

Prepare the data: transform the text data into a numerical representation

Pre-process the data: e.g. normalization

Train a classifier

Optimize hyperparameters

Output

For an unseen text document, predict the main category to which it belongs

Data preprocessing – Bag-of-words model

- This is the first sentence
- This sentence is the second sentence
- And this is the third sentence
- Is this the first sentence

Data preprocessing – Bag-of-words model

- This is the first sentence
- This sentence is the second sentence
- And this is the third sentence
- Is this the first sentence

this is the first sentence second and third

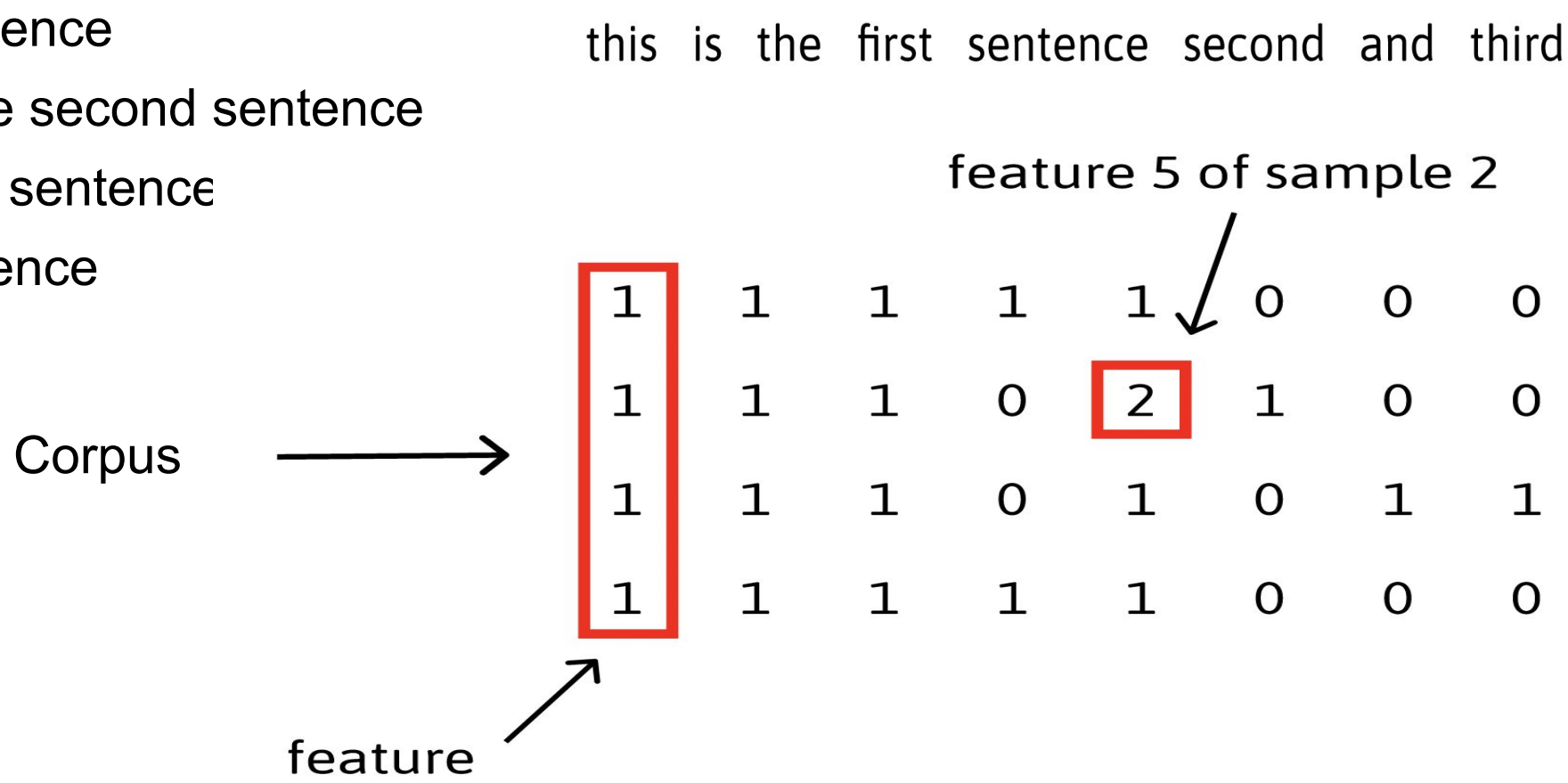
Data preprocessing – Bag-of-words model

- This is the first sentence
- This sentence is the second sentence
- And this is the third sentence
- Is this the first sentence

this	is	the	first	sentence	second	and	third
1	1	1	1	1	0	0	0
1	1	1	0	2	1	0	0
1	1	1	0	1	0	1	1
1	1	1	1	1	0	0	0

Data preprocessing – Bag-of-words model

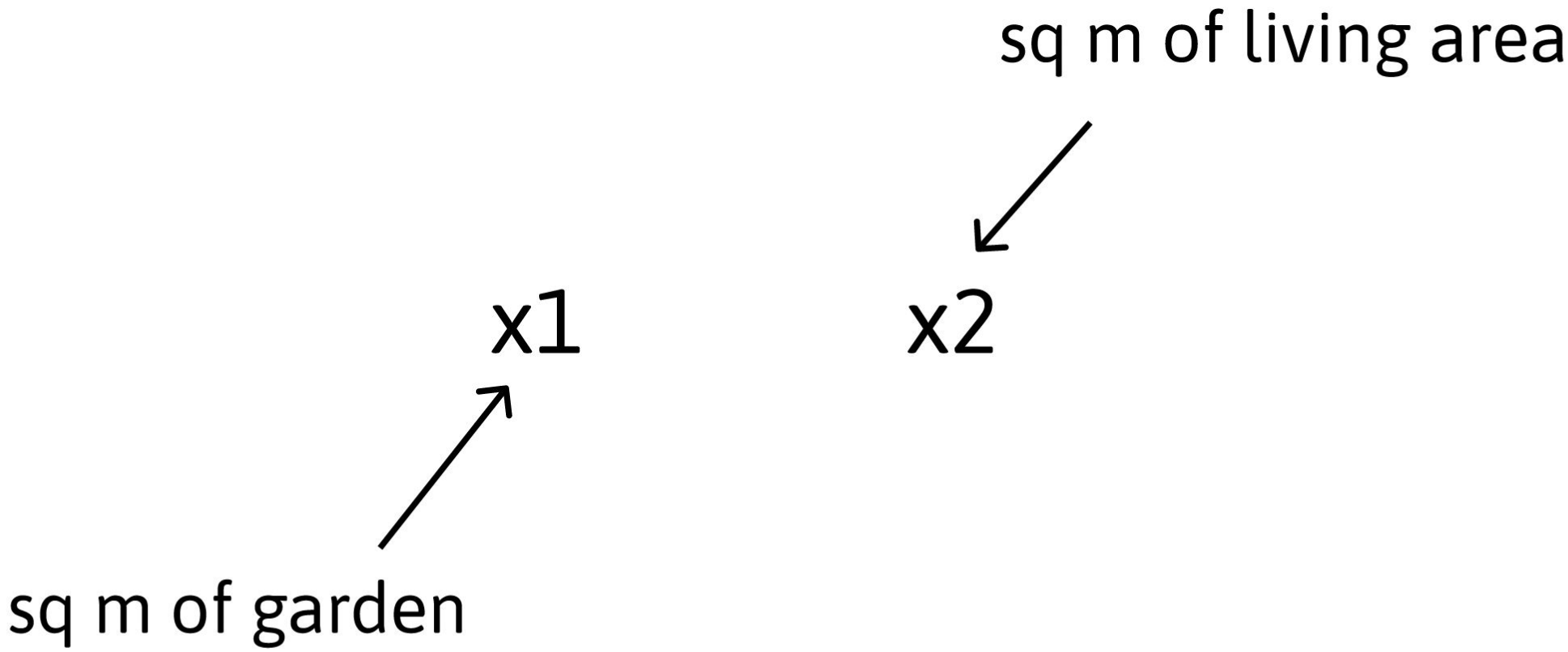
- This is the first sentence
- This sentence is the second sentence
- And this is the third sentence
- Is this the first sentence



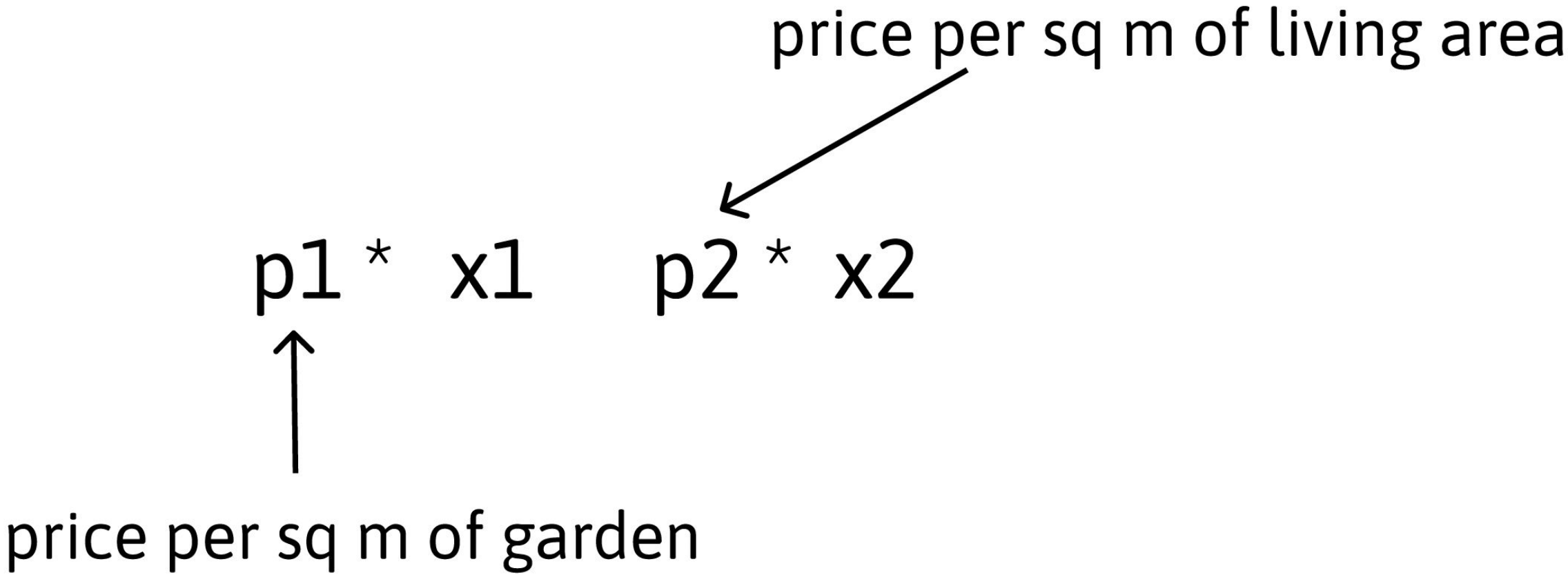
How do we perform classification?

Let's take a more practical example

Price house prediction



Price house prediction



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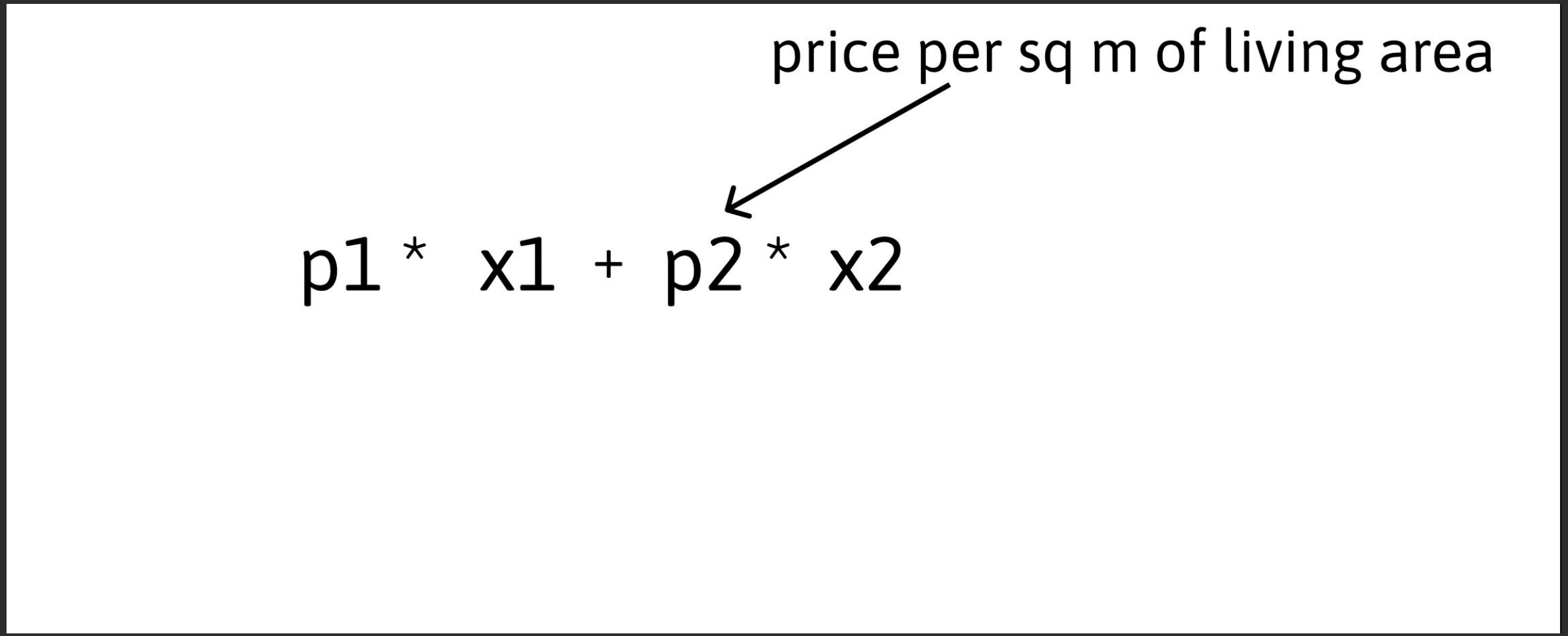
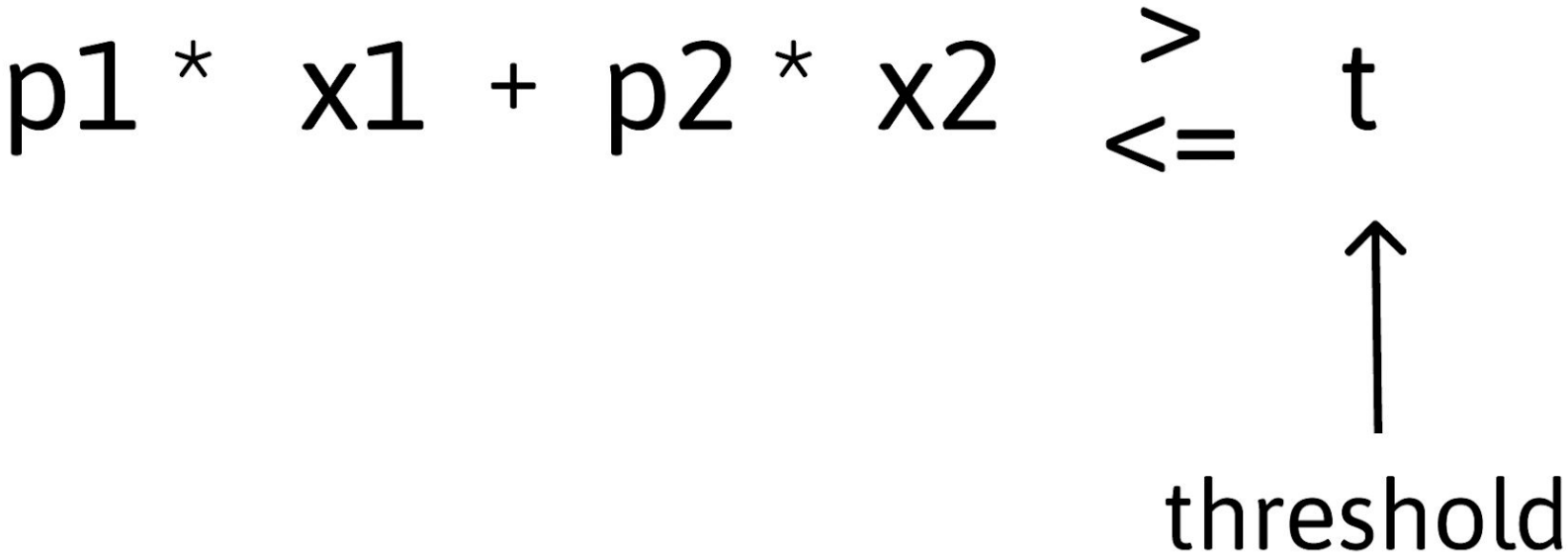


Price house prediction

Decide whether is an expensive house or not?



Price house prediction

Decide whether is an expensive house or not?

$$p1 * x1 + p2 * x2 - t \begin{matrix} > \\ <= \end{matrix} 0$$

Price house prediction

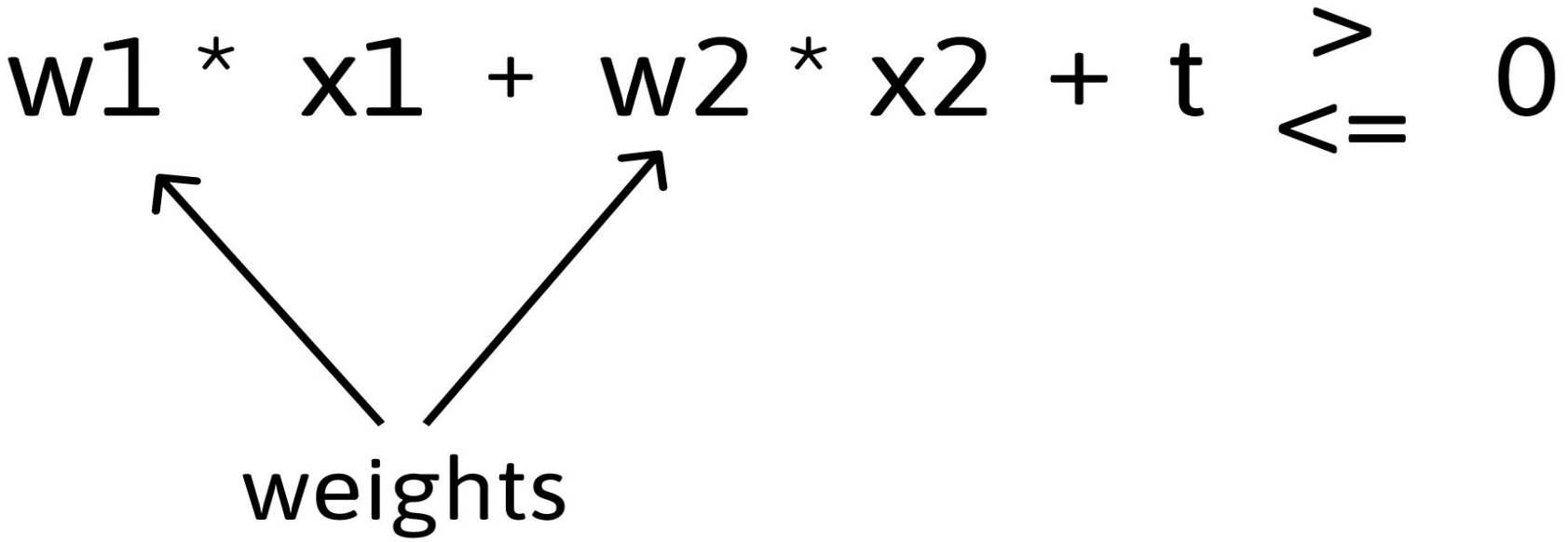
Decide whether is an expensive house or not?

$$p1 * x1 + p2 * x2 + t \gtrless 0$$

sign doesn't matter

Price house prediction

Decide whether is an expensive house or not?



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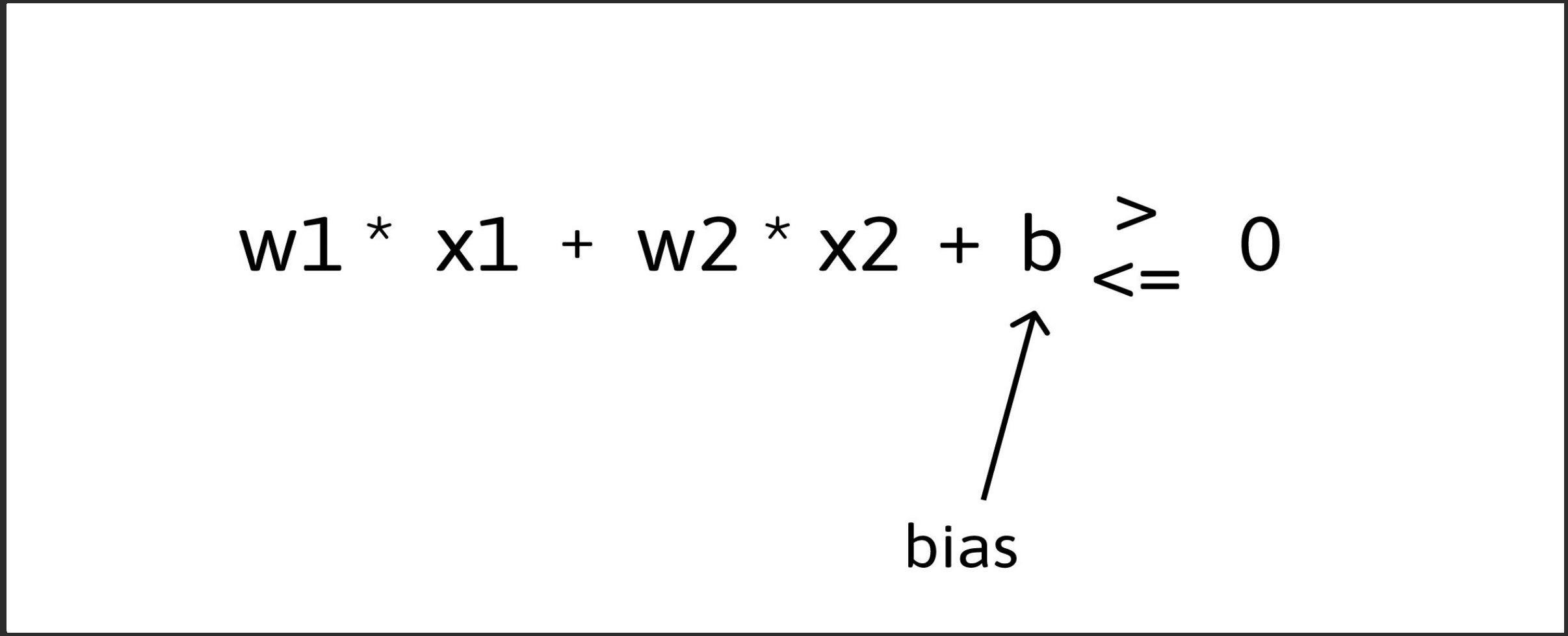

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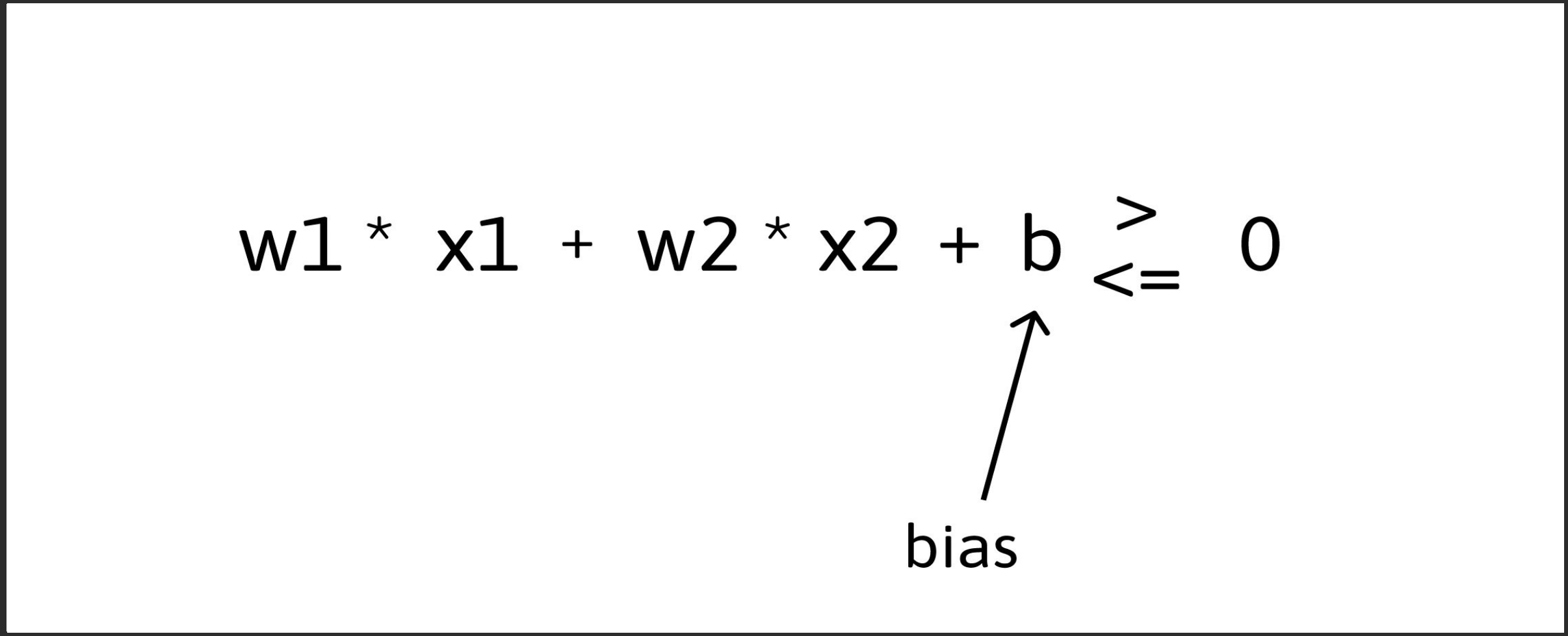


Price house prediction
Solving the problem

Training set

(20, 10) 1
(10, 10) 1
(5, 5) 0

Test set

(15, 7)

Price house prediction
Solving the problem

Training set

(20, 10) 1
(10, 10) 1
(5, 5) 0

Determine w1, w2 and b such that

w1 * 20 + w2 * 10 + b > 0 and
w1 * 10 + w2 * 10 + b > 0 and
w1 * 5 + w2 * 5 + b <= 0
at the same time

Test set

(15, 7)

Price house prediction
Solving the problem

Training set

(20, 10) 1
(10, 10) 1
(5, 5) 0

Determine w1, w2 and b such that

w1 * 20 + w2 * 10 + b > 0 and
w1 * 10 + w2 * 10 + b > 0 and
w1 * 5 + w2 * 5 + b <= 0
at the same time

Test set

(15, 7)

See whether
w1 * 15 + w2 * 7 + b $\begin{matrix} > \\ <= \end{matrix}$ 0

Price house prediction
Solving the problem

Training set

(20, 10) 1
(10, 10) 1
(5, 5) 0

Determine w1, w2 and b such that

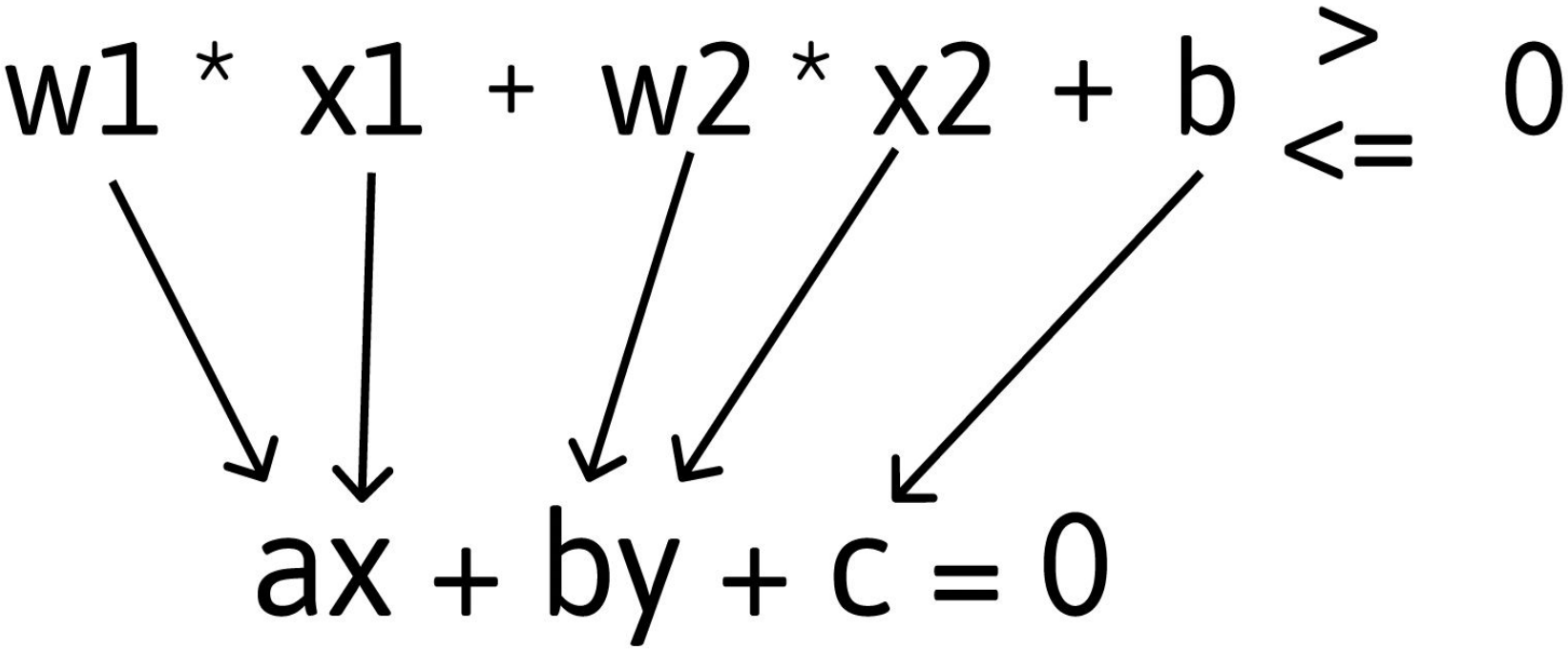
w1 * 20 + w2 * 10 + b > 0 and
w1 * 10 + w2 * 10 + b > 0 and
w1 * 5 + w2 * 5 + b <= 0
at the same time

Test set

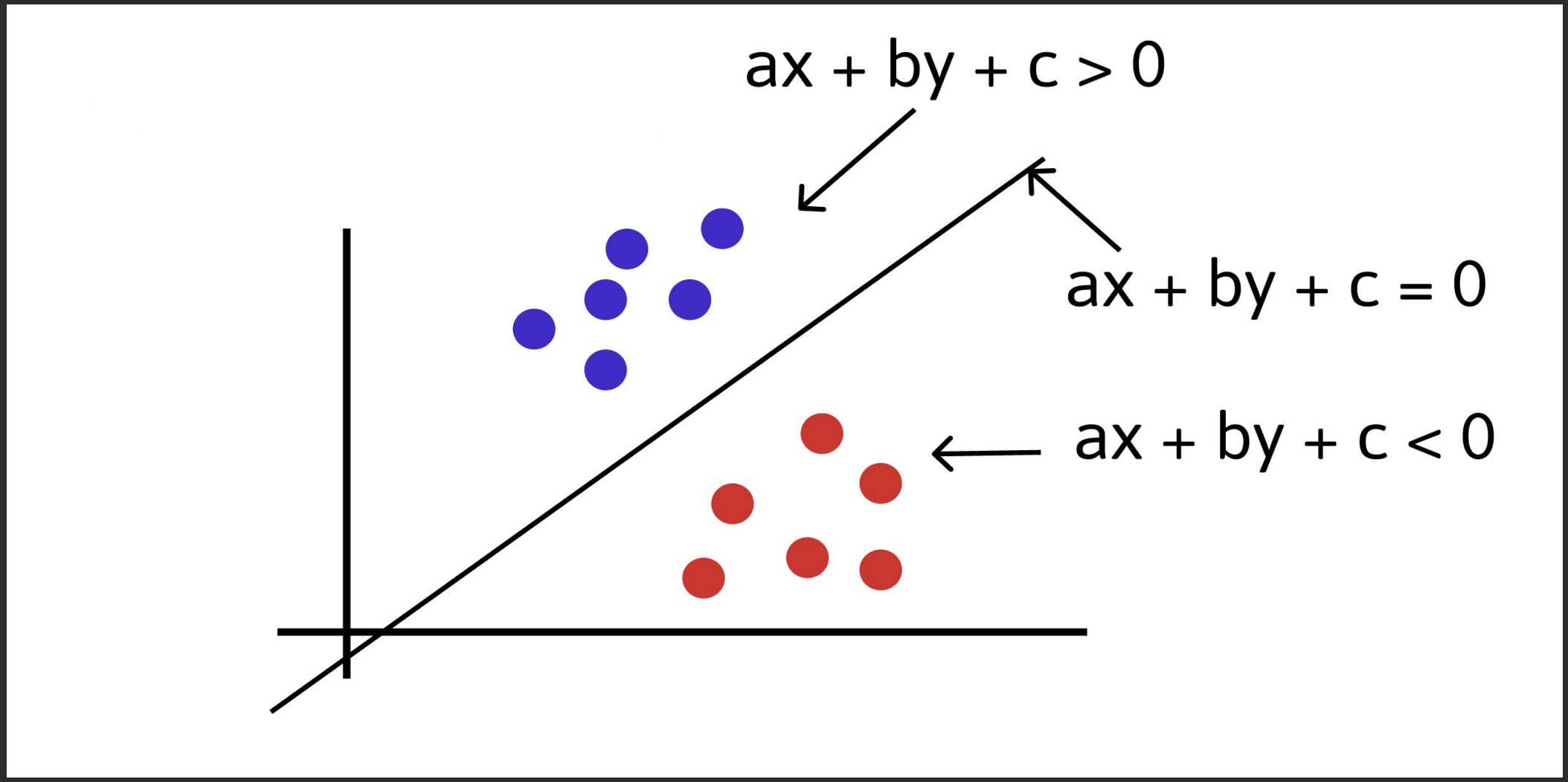
(15, 7)

See whether
w1 * 15 + w2 * 7 + b $\begin{matrix} > \\ <= \end{matrix}$ 0

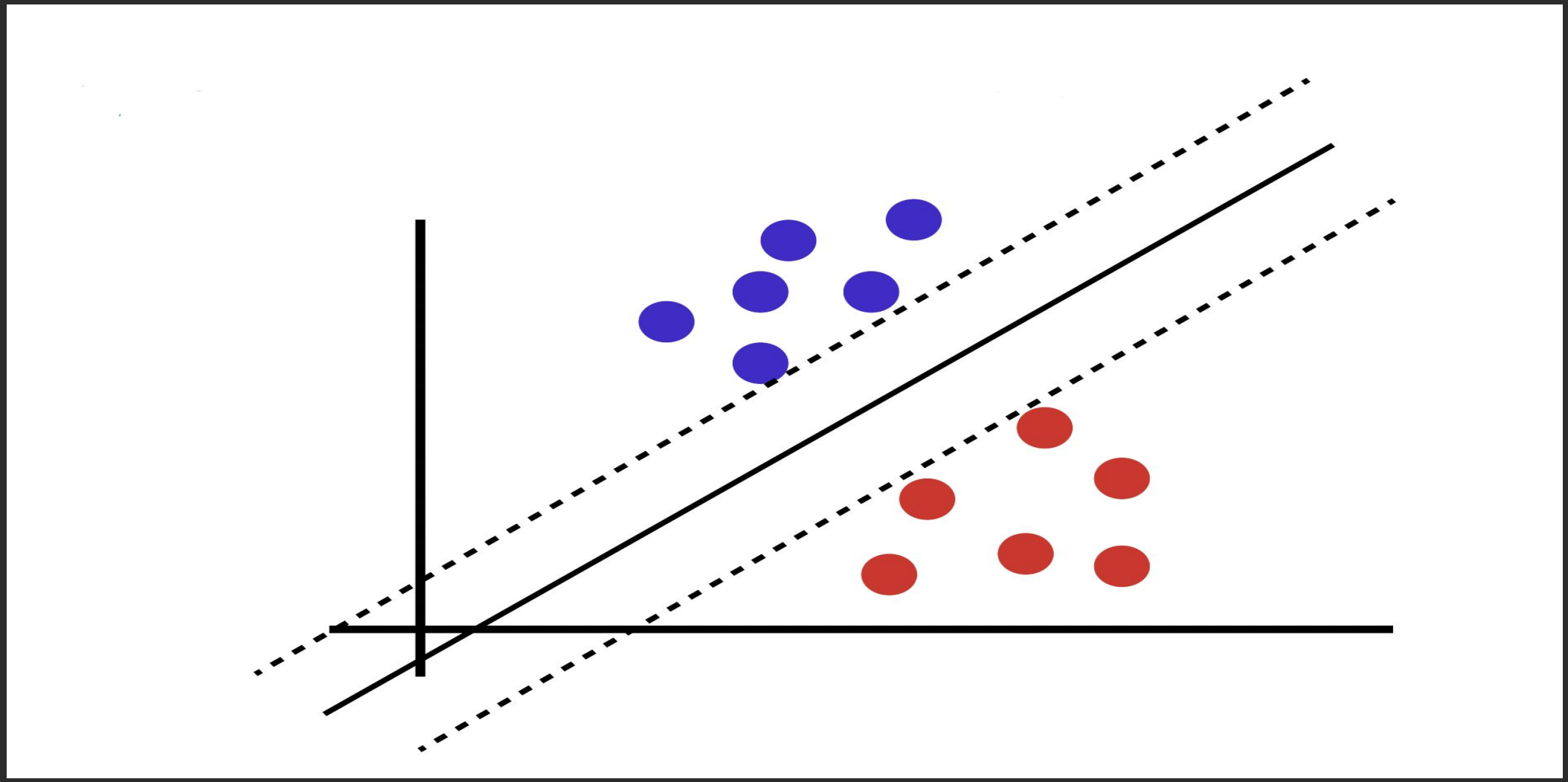
Price house prediction
Solving the problem



Price house prediction
Solving the problem



Support Vector Machines



Support Vector Machines

Training set

(20, 10) 1
(10, 10) 1
(5, 5) 0

Determine w1, w2 and b such that

$w1 * 20 + w2 * 10 + b > 0$ and
$w1 * 10 + w2 * 10 + b > 0$ and
$w1 * 5 + w2 * 5 + b <= 0$
at the same time

While minimizing $||w||$, where $w = (w1, w2, b)$

Support Vector Machines

Training set

(20, 10) 1
(10, 10) 1
(5, 5) 0

Determine w1, w2 and b such that

$w1 * 20 + w2 * 10 + b >= 1$ and
$w1 * 10 + w2 * 10 + b >= 1$ and
$w1 * 5 + w2 * 5 + b <= -1$
at the same time

While minimizing $||w||$, where $w = (w1, w2, b)$

How do we know if our model is good? (Validation)

- Split the available annotated data, e.g. 90% for training, 10% for validation
- Train the model on the training data and test the current configuration on the validation data
- Choose the model with the best performance on the validation data

Tips for competition: You can also train the best performing model on all the data (train + val) before submitting

Q&A

Thank you!