

TOPICS TO BE COVERED



- 1 Introduction to Linear Algebra ft: Machine Learning
- 2 Vectors , Matrices and Tensors
- 3 Machine Learning Algorithms
- 4 Applications and Examples of LA wrt. Machine Learning
- 5 Conclusion
- 6 Contribution and References

Introduction to Linear Algebra

associated with Machine Learning

1. Linear Algebra = Faithful SideKick
2. Why Study Linear Algebra
3. Where is Linear Algebra in ML?

The Bond

Linear Algebra

$$\begin{aligned} & C_1(x) \cos 2 \\ &= \frac{y(x - \sqrt{x^2 + 3})}{x^2 + 3} \Leftrightarrow \frac{dy}{y} \\ & \Rightarrow \int \frac{dy}{y} = \int \frac{x dx}{x^2 + 3} - \int \frac{dx}{\sqrt{1 + \sin^2 x}} \\ &= \left(4 + 4 \sin \frac{x}{2} \cdot \ln \frac{1 + \sin x}{\cos x} \right) \end{aligned}$$

Machine Learning

MACHINE
LEARNING

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**Linear = Faithful
Algebra = SideKick**

If Machine Learning was Sherlock, Linear Algebra would be Dr. Watson.



LINEAR ALGEBRA



Why Study Linear Algebra ??

The concepts of Linear Algebra are crucial for understanding the theory behind Machine Learning.

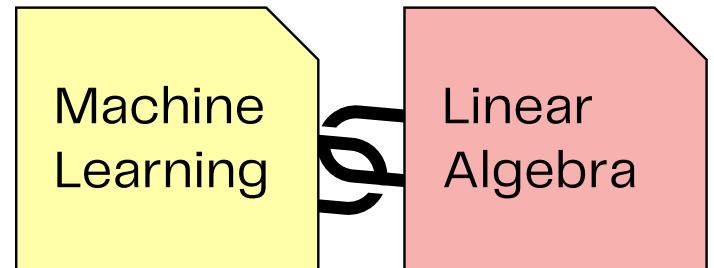
They give you better intuition for how algorithms really work under the hood, which enables you to make better decisions.

LINEAR ALGEBRA



Where is Linear Algebra in ML?

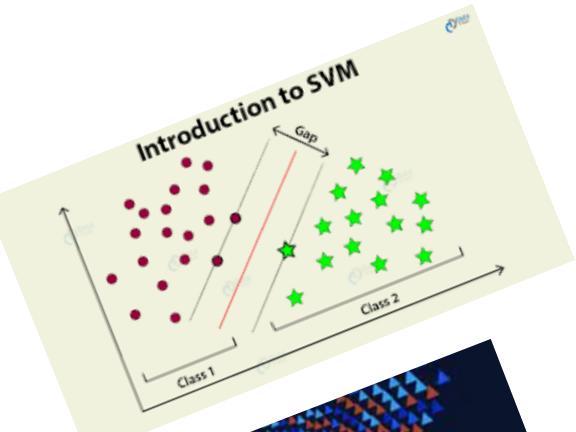
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Believe me or not but everywhere !!

In pure ML

- -Data Sets
- Regressions
- One-Hot Encoding
- Covariance Matrix
- Support Vector Machine Classifications



In NLP

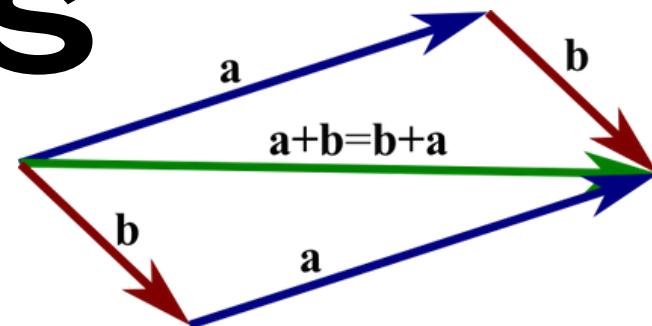
- Word Embeddings
Latent Semantic



In Computer Vision

- Image Representation as Tensors
- Convolution and Image Processing

Vectors



Matrices

$$\mathbf{A} = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$$

Tensors

tensor

tensor of dimensions [6] (vector of dimension 6)

tensor of dimensions [6x4] (matrix 6 by 4)

tensor of dimensions [4x4x2]

't'	3	1	4	1
'e'	5	9	2	6
'n'	5	3	5	8
's'	9	7	9	3
'o'	2	3	8	4
'r'	6	2	6	4

1 Vectors

DEFINITION

PURPOSE

2 Matrices

DEFINITION

PURPOSE

3 Tensors

BRIEF DISCUSSION

VECTORS

1

What

2

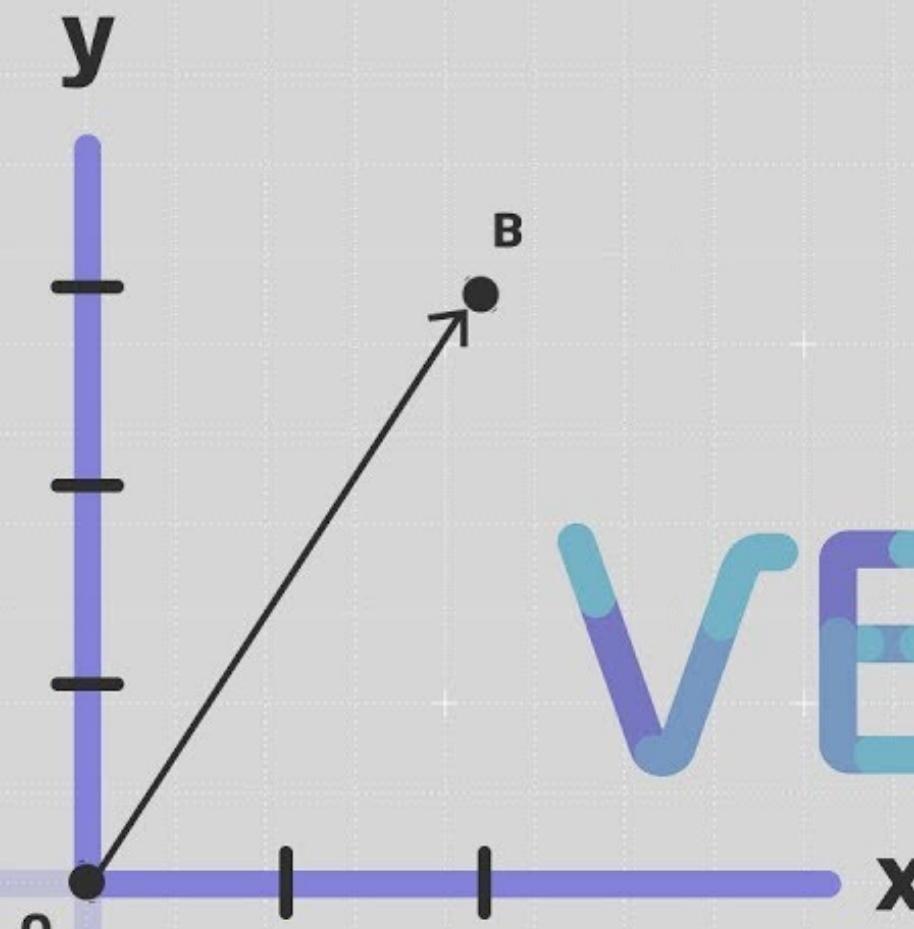
Definition

3

Purpose



Brainstroming Vectors



WHAT ARE
VECTORS?



Vectors

A vector is a 1D array.
For instance, a point in
space can be defined as
a vector of three
coordinates (x, y, z).

Usually, it is defined in
such a way that it has
both the magnitude and
the direction.

Matrices

1

What

2

Definition

3

Purpose



Brainstorming Matrices



Matrices

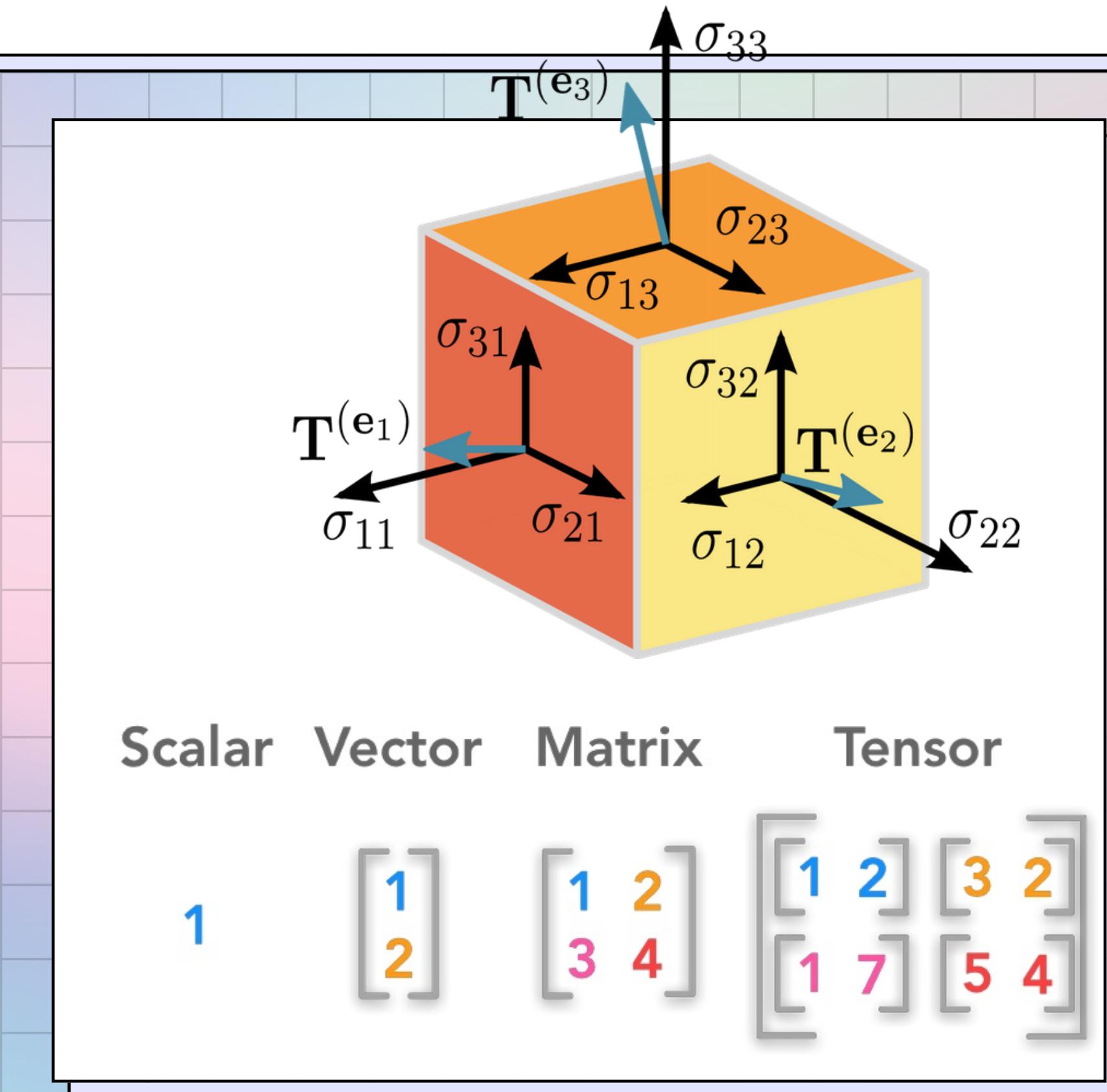
A matrix is a two-dimensional array of numbers, that has a fixed number of rows and columns. It contains a number at the intersection of each row and each column.

A matrix is usually denoted by square brackets [].

Brief discussion on Tensors



A tensor is an apparent form of vectors and matrices and can be easily understood as a multidimensional array.



Machine Learning Algorithms

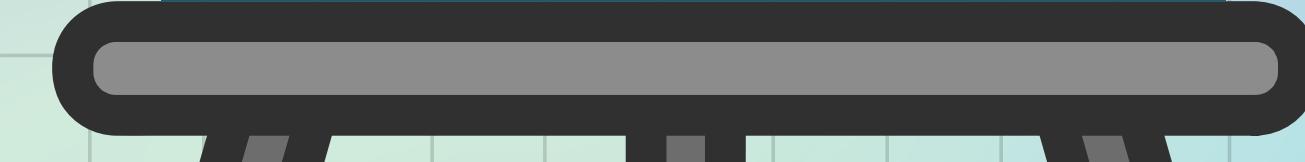
Ft. Linear Algebra



Linear
Regression

Support
Vector
Machine

Decision
Trees

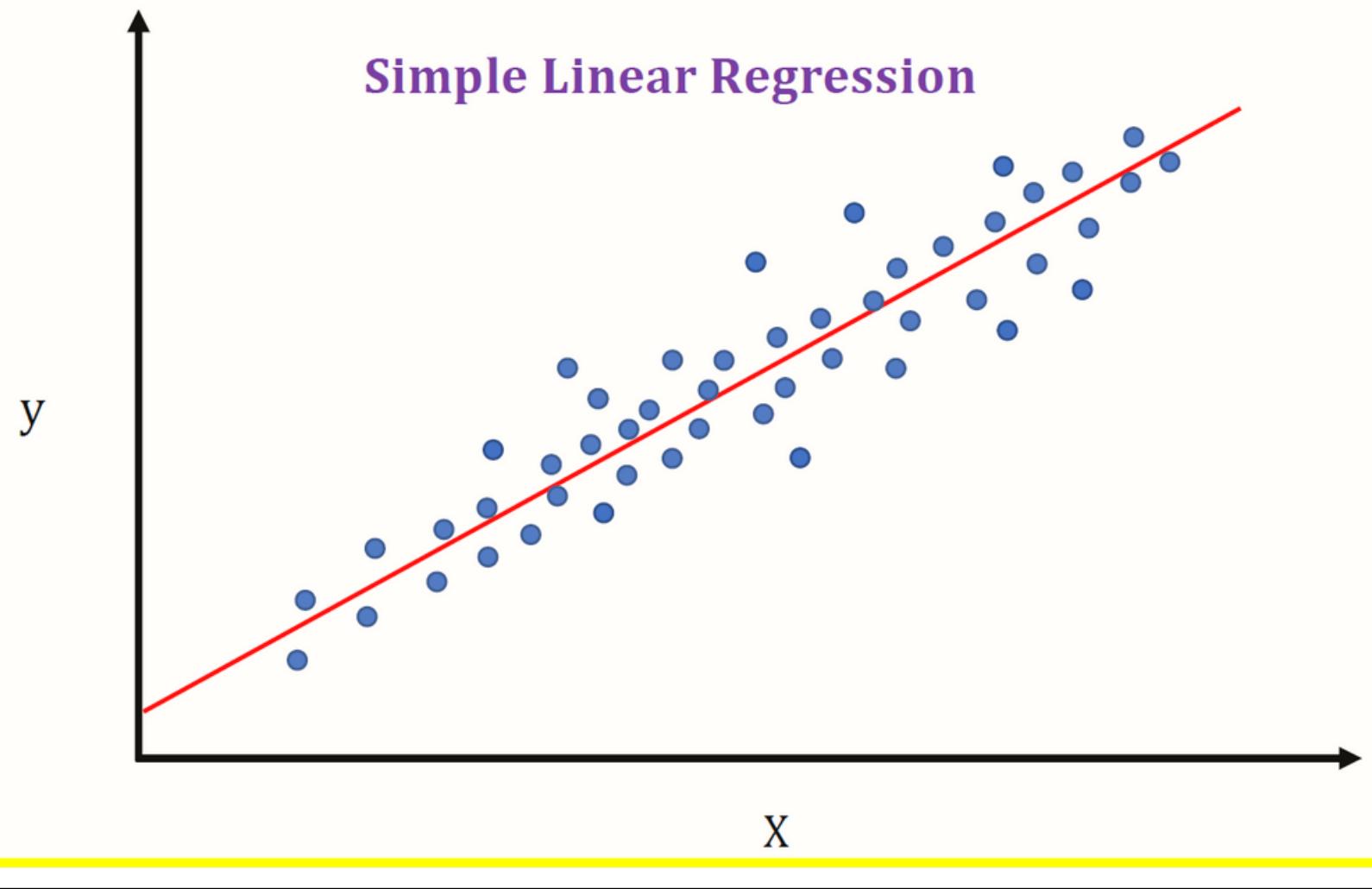


One of the most used methods of data modelling

○ ○ ○ ○

Linear Regression Algorithm

Simple Linear Regression



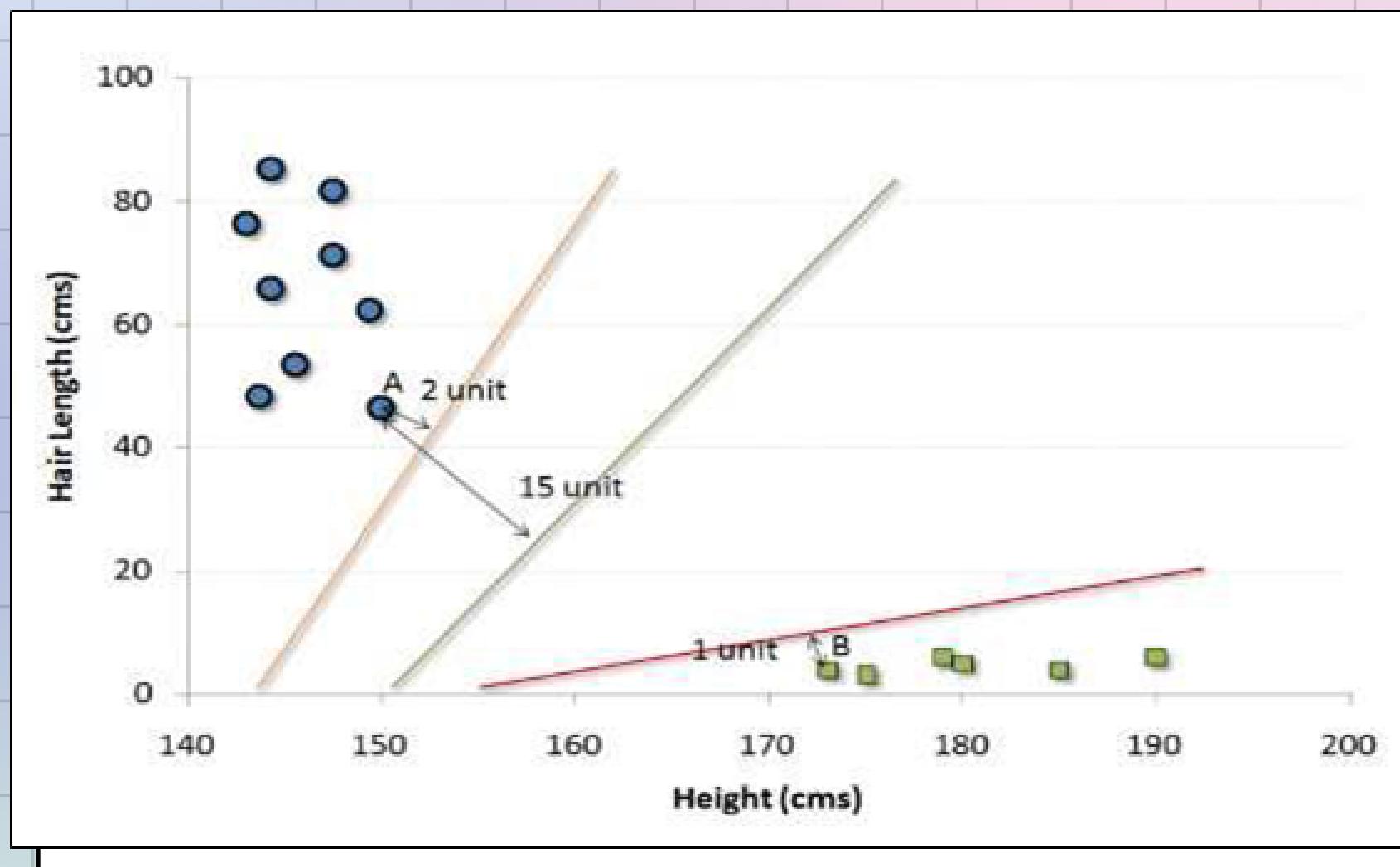
That's exactly what linear regression does

After finding the linear relationship between the two variables, we simply calculate the linear relationship formula between them and use it to predict new values of one variable based on the value of the other variable.

Let's Understand with an example

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Support Vector Machine Algorithm



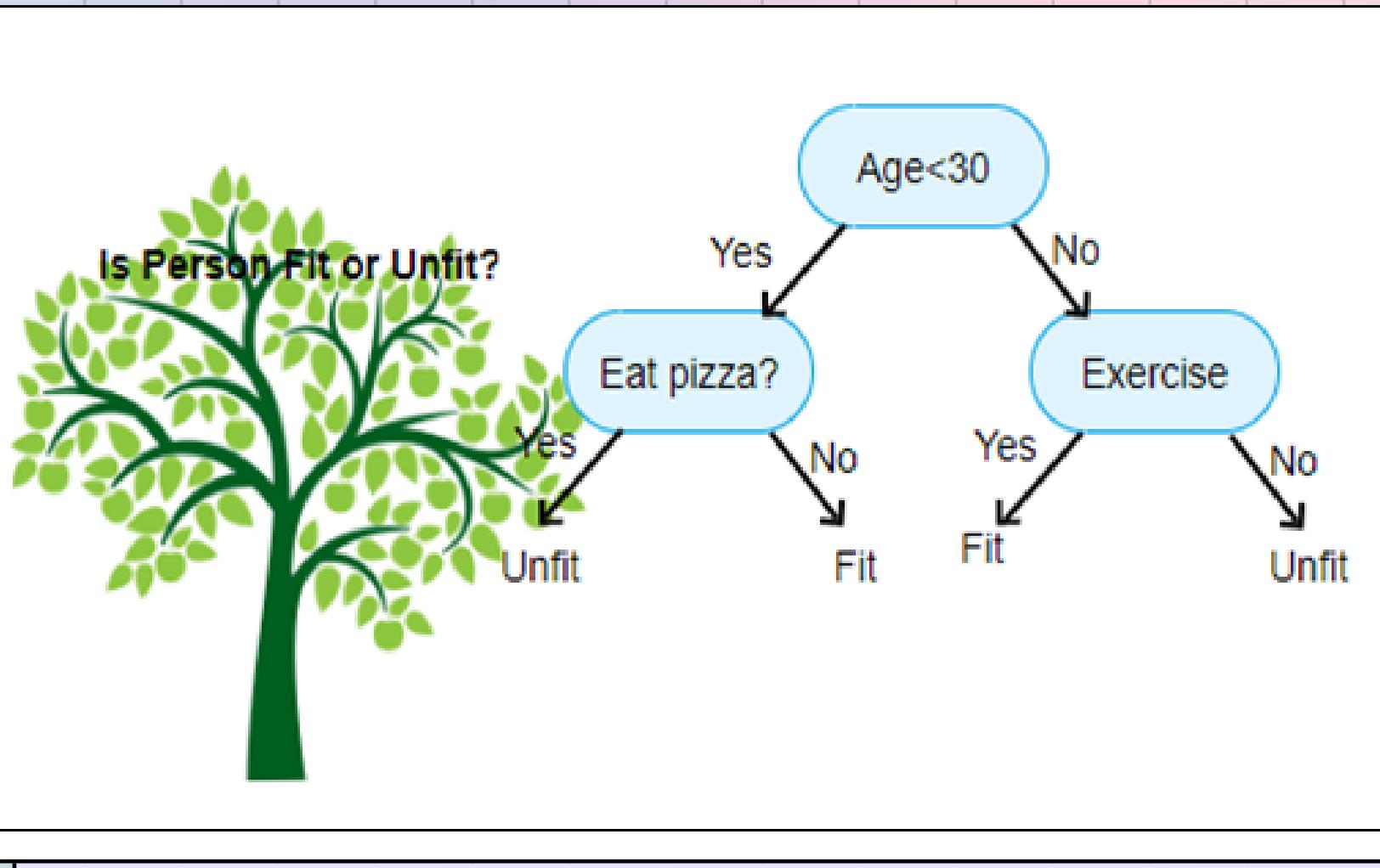
what is the best line in this issue?

An easy way to do this is to create an optimal cluster. Finally select the boundary that is the largest of all available clusters. Here the answer is the midline , a good approximation of the border that is far from both.

Let's Understand with an example

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Decision Tree Algorithm



How does the Decision Tree algorithm Work?

A decision tree is a very specific type of probability tree that enables you to make a decision about some kind of process. For example, you might want to choose between manufacturing item A or item B, or investing in choice 1, choice 2, or choice 3.

APPLICATIONS OF LINEAR ALGEBRA IN MACHINE LEARNING

A P P L I C A T I O N

Linear Algebra Notation

- Read the outline of the algorithms within the textbooks
- Description of recent techniques in studies papers
- Briefly describe your techniques for different doctors :)

Linear Algebra Arithmetic

- The way to add, subtract, and multiply scalars, vectors and matrices
- Tensor multiplication and instantaneous multiplication

Linear Algebra for Statistics

- Vectors for the methods and styles of information
- Principal Component Analysis

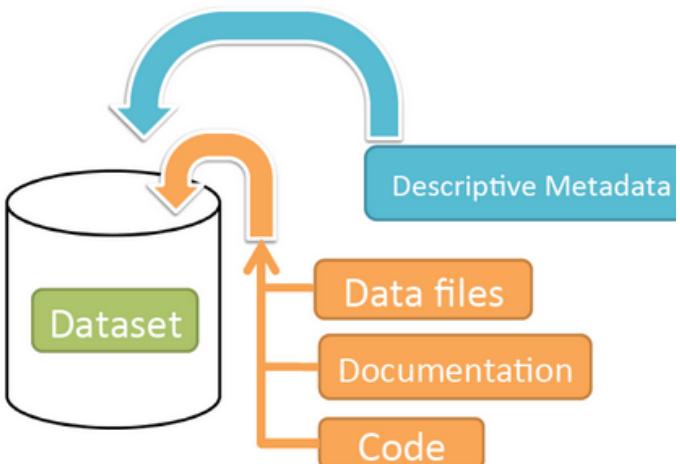
Matrix Factorization

- Matrix Rationalization is a vital device in linear algebra
- “Gadget Mastering” strategies

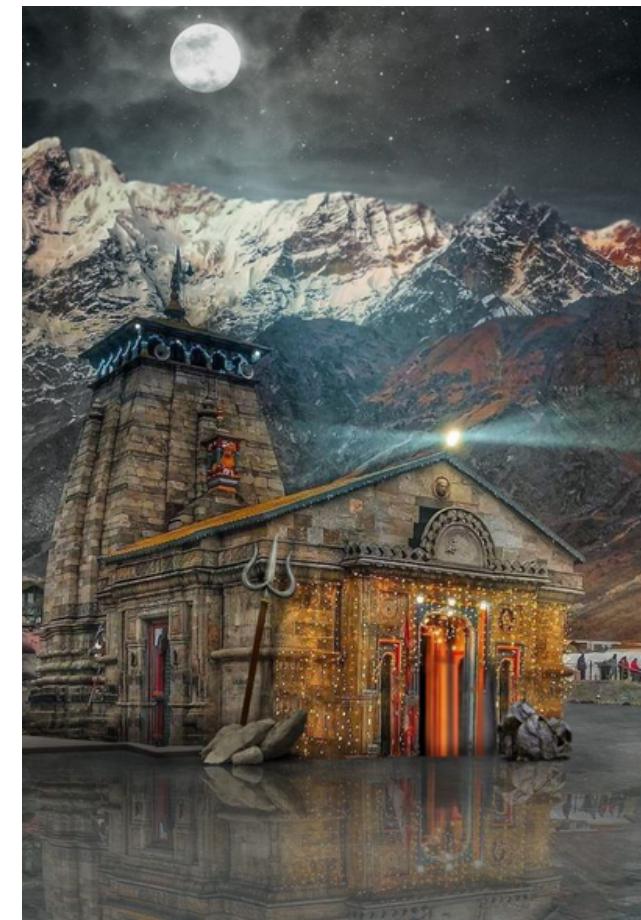
EXAMPLES OF LINEAR ALGEBRA IN MACHINE LEARNING

EXAMPLE

Datasets and information files



Images and photos

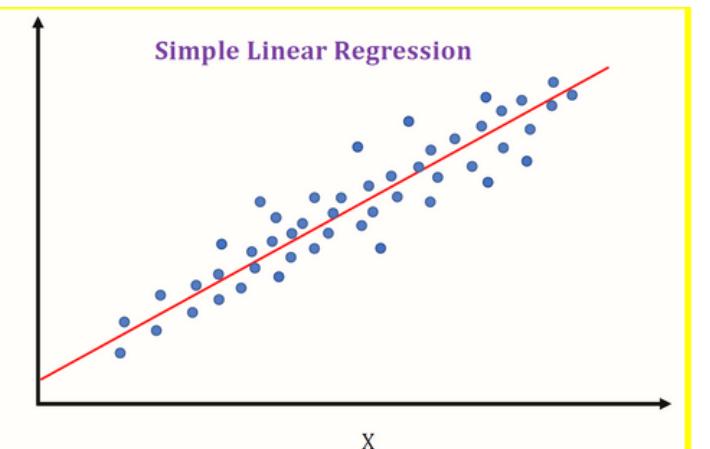


One Hot Encoding

Color
Red
Red
Yellow
Green
Yellow

	Red	Yellow	Green
1	1	0	0
1	1	0	0
0	0	1	0
0	0	0	1

Linear Regression



Conclusions

o o o o

1. calculations in a more computationally efficient way.
2. useful in visualizing the operations

**LA and
ML**

**scaler
vectors
matrices**

**ML
Algorithms**

**Applications
of LA in ML**

**Examples of
LA in ML**

**That's a
wrap!**

o o o o

here we
end..

References

1. <https://pabloinsente.github.io/intro-linear-algebra>
2. <https://machinelearningmastery.com/introduction-to-tensors-for-machine-learning/>
3. <https://machinelearningmastery.com/examples-of-linear-algebra-in-machine-learning/>
4. <https://www.educba.com/linear-algebra-in-machine-learning/>
5. <https://blog.usejournal.com/easy-as-pie-linear-algebra-for-machine-learning-98acfec084f>



Thanks a lot for
hearing us out !!

Have a great day

THANK
you! . . .

