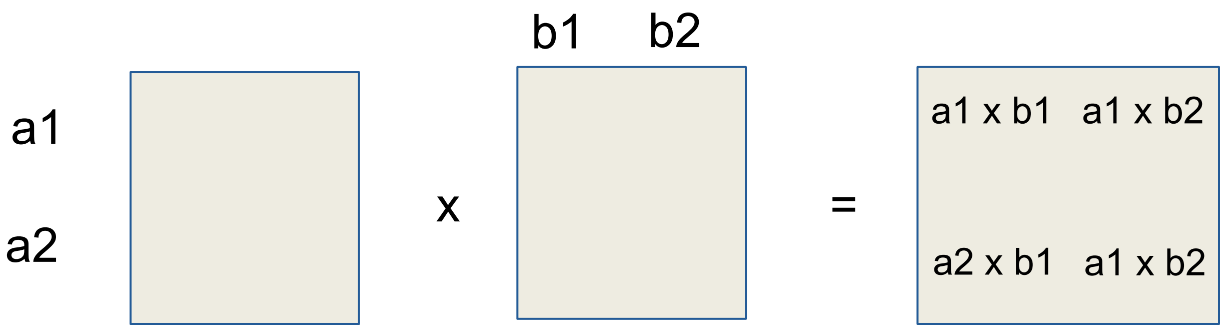
Linear Algebra as Transformation

Introduction

Linear Algebra as Transformation



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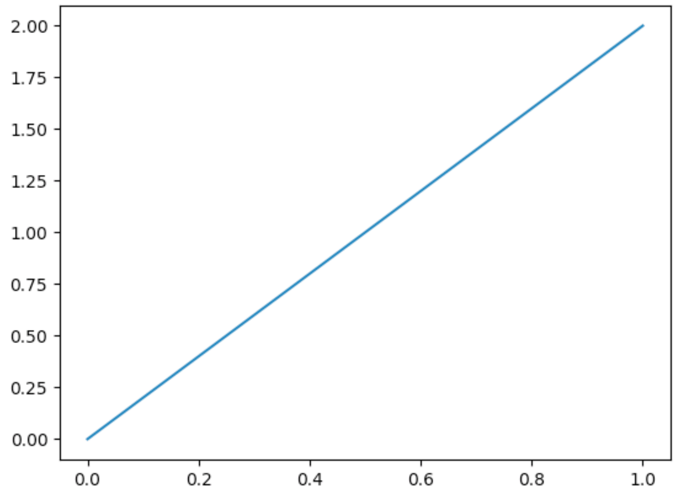
Vector Manipulations

Linear Algebra as Transformation

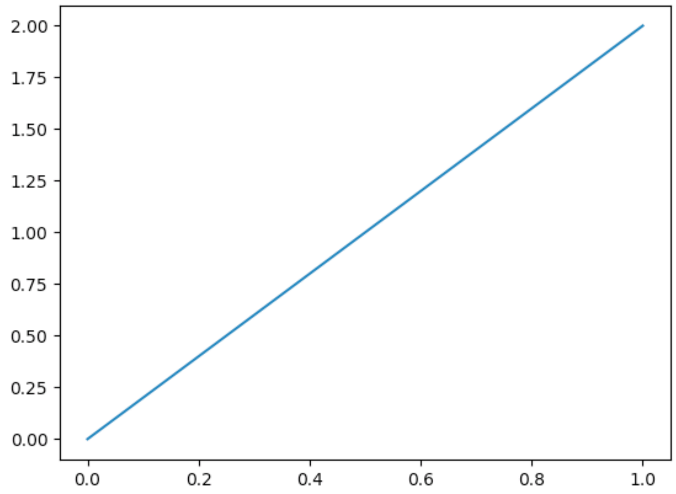
- Row vector
- Column vector




```
import matplotlib.pyplot as plt
import numpy as np


V = np.array([[0,1],[0,2]])
plt.plot(*V)
plt.show()
```

Linear Algebra as Transformation

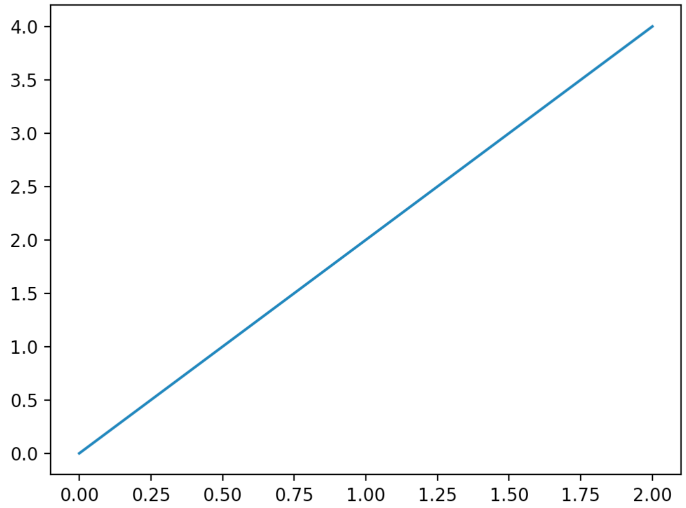
- Row vector
- Column vector




```
import matplotlib.pyplot as plt
import numpy as np


V = np.array([[0,1],[0,2]])
plt.plot(*V)
plt.show()

idenity_matrix = np.array([[1,0],
                           [0,1]])
plt.plot(*np.dot(V,idenity_matrix))
plt.show()
```

Linear Algebra as Transformation

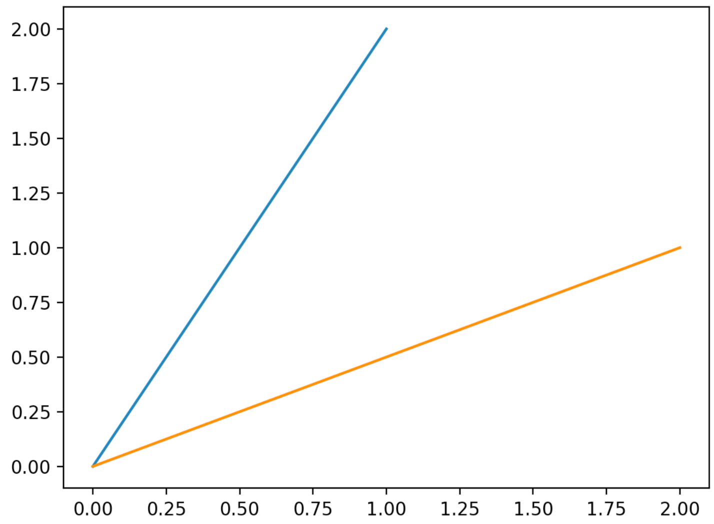
- Row vector
- Column vector
- Multiplication




```
import matplotlib.pyplot as plt
import numpy as np


V = np.array([[0,1],[0,2]])
plt.plot(*V)
plt.show()

idenity_matrix = np.array([[1,0],
                           [0,1]])
plt.plot(*np.dot(V,idenity_matrix))
plt.show()

multiplication_matrix = np.array([[2,0],
                                  [0,2]])
plt.plot(*np.dot(V,multiplication_matrix))
plt.show()
```

Linear Algebra as Transformation

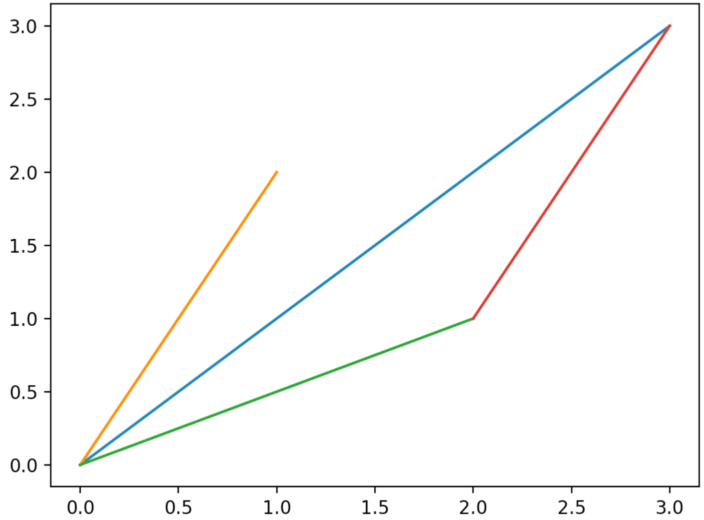
- Row vector
- Column vector
- Multiplication
- Vector addition




```
import matplotlib.pyplot as plt
import numpy as np


V = np.array([[0,1],[0,2]])

plt.plot(*V)

V_2 = np.array([[0,2],
                [0,1]])
plt.plot(*V_2)
```

Linear Algebra as Transformation

- Row vector
- Column vector
- Multiplication
- Vector addition




```
import matplotlib.pyplot as plt
import numpy as np


V = np.array([[0,1],[0,2]])

plt.plot(*V)

V_2 = np.array([[0,2],
                [0,1]])
plt.plot(*V_2)


V_3 = np.array([[2,3],
                [1,3]])

plt.plot(*(V+V_2))
plt.plot(*V_3)
plt.show()
```

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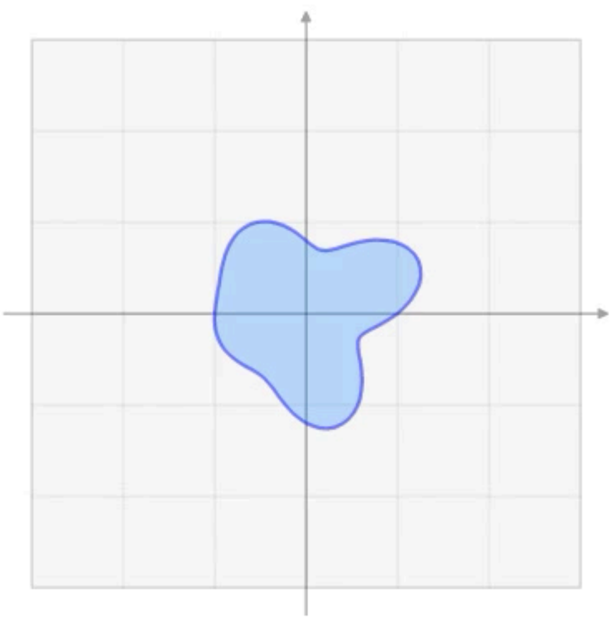
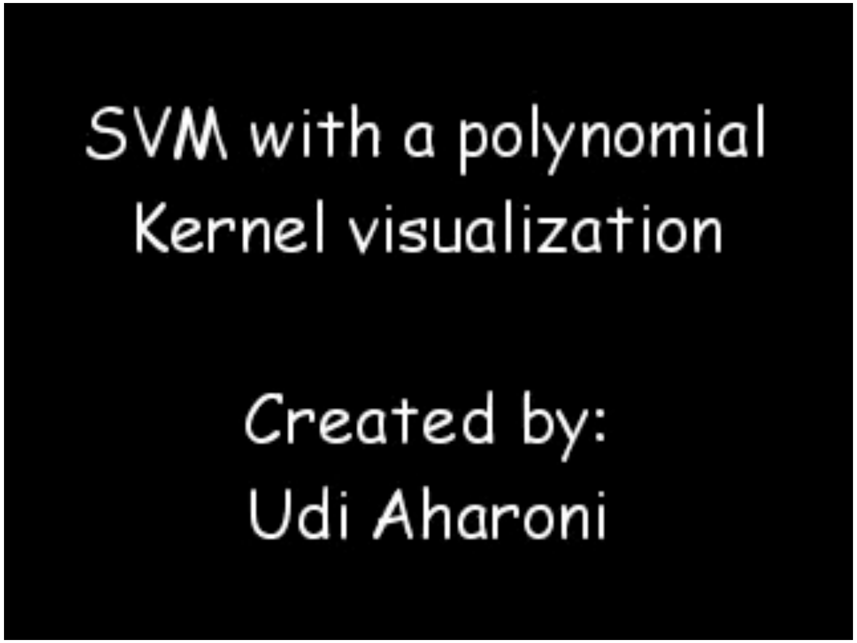
Linear Algebra as Transformation

Linear Algebra as Transformation

Affine Transformations



SVM Kernel

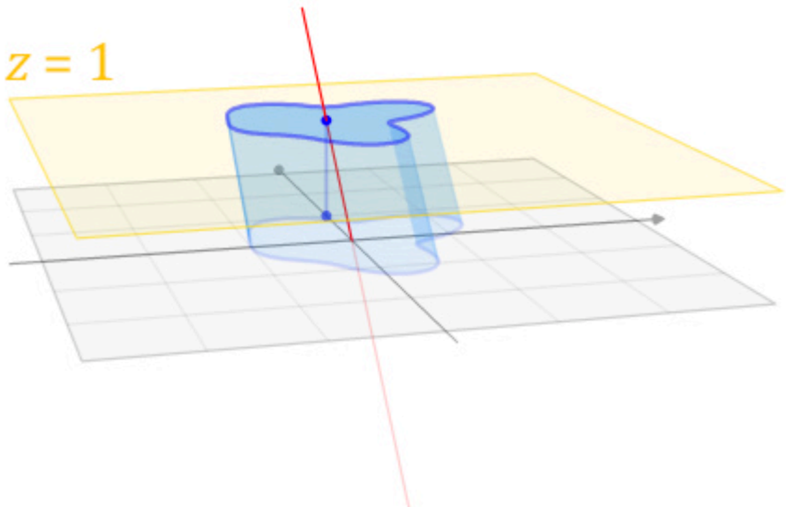


https://en.wikipedia.org/wiki/File:Affine_transformations.ogv#

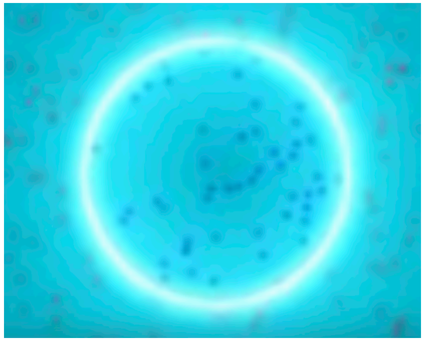
https://www.youtube.com/watch?v=3liCbRZPrZA

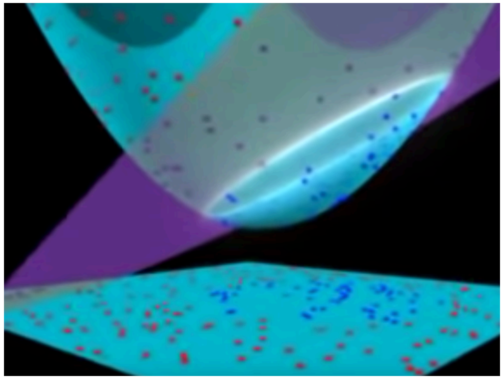
Linear Algebra as Transformation

Affine Transformations



SVM Kernel





https://en.wikipedia.org/wiki/File:Affine_transformations.ogv#

https://www.youtube.com/watch?v=3liCbRZPrZA

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Eigenvector

Eigenvector

- Eigenvector is a vector that only gets scaled when multiplied by M.
- Eigenvectors are linearly independent.
- If eigenvalues = zero: the matrix is singular (i.e. not invertible).

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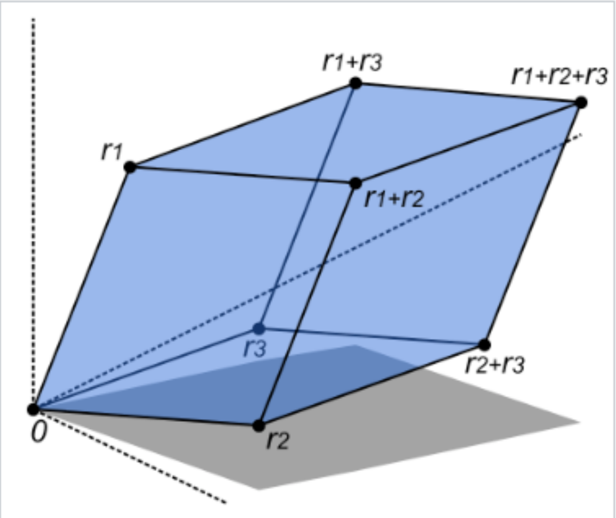
Determinant

Determinant

- Determinant describes a transformation that expands or contracts the space.
- Determinant = 0, space is entirely contracted.
- Determinant = 1, space is entirely preserved.



The volume of this parallelepiped is the absolute value of the determinant of the matrix formed by the rows constructed from the vectors r1, r2, and r3.

https://en.wikipedia.org/wiki/Determinant

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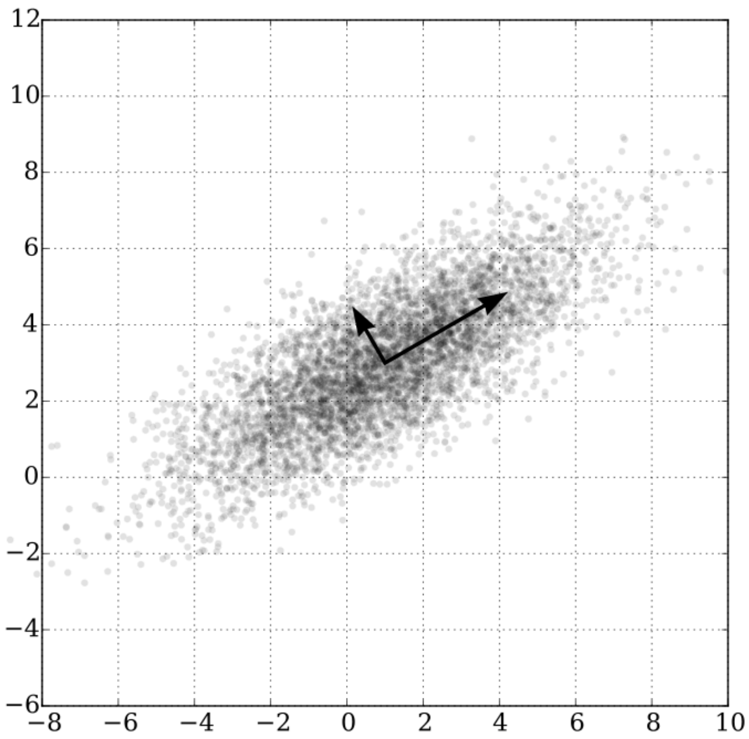
Principle Component Analysis

Principle Component Analysis

- Biggest eigenvalue's corresponding eigenvector is the dimension in which we see the greatest variance.
- This allows us to represent our data in a way that doesn't contort the space.



https://en.wikipedia.org/wiki/Principal_component_analysis

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