

Basic Matrix Operations

Spoken Tutorial Project

<http://spoken-tutorial.org>

National Mission on Education through ICT

<http://sakshat.ac.in>

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Learning Objectives



Learning Objectives

- ▶ **Create matrices from lists**



Learning Objectives

- ▶ **Create matrices from lists**
- ▶ **Perform basic matrix operations like**



Learning Objectives

- ▶ Create matrices from lists
- ▶ Perform basic matrix operations like
 - ▶ **Addition**



Learning Objectives

- ▶ Create matrices from lists
- ▶ Perform basic matrix operations like
 - ▶ Addition
 - ▶ Subtraction



Learning Objectives

- ▶ Create matrices from lists
- ▶ Perform basic matrix operations like
 - ▶ Addition
 - ▶ Subtraction
 - ▶ **Multiplication**



Learning Objectives

- **Perform operations to find out**



Learning Objectives

- ▶ Perform operations to find out
 - ▶ **Determinant of a matrix**



Learning Objectives

- ▶ Perform operations to find out
 - ▶ Determinant of a matrix
 - ▶ **Inverse of a matrix**



Learning Objectives

- ▶ Perform operations to find out
 - ▶ Determinant of a matrix
 - ▶ Inverse of a matrix
 - ▶ **Eigen values and Eigen vectors of a matrix**



System Specifications



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► Ubuntu Linux 16.04



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- ▶ **Ubuntu Linux 16.04**
- ▶ **Python 3.4.3**



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- ▶ **Python 3.4.3**
- ▶ **IPython 5.1.0**



Pre-requisite



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► Lists



Pre-requisite

- ▶ **Lists**
- ▶ **Arrays and accessing parts of arrays**



Pre-requisite

- ▶ **Lists**
- ▶ **Arrays and accessing parts of arrays**
- ▶ **Theoretical knowledge of matrix operations**



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Pre-requisite

- ▶ **Lists**
- ▶ **Arrays and accessing parts of arrays**
- ▶ **Theoretical knowledge of matrix operations**

If not, see the relevant Python tutorials on <http://spoken-tutorial.org>



Matrix

- ▶ In Python, we create a matrix using **numpy** matrix class



Matrix

- ▶ In Python, we create a matrix using **numpy** matrix class
- ▶ Matrix operations can be done using **numpy** operators and functions





- To convert an array to a matrix, use the **asmatrix** method in **numpy** module



- ▶ To convert an array to a matrix, use the **asmatrix** method in **numpy** module
- ▶ We can use **arange** and **reshape** methods to generate an array



Exercise 1

- ▶ Create a two dimensional matrix **m3** of shape (2, 4) with the elements 5, 6, 7, 8, 9, 10, 11, 12
- ▶ Hint: Use **arange()** and **reshape()** methods and **asmatrix()** function



Determinant of a matrix

- ▶ We can get the determinant of a square matrix by using the function `det()` in `numpy.linalg` module



Exercise 2

- Find out the determinant of this 3X3 matrix
 $[[2, -3, 1], [2, 0, -1], [1, 4, 5]]$



Inverse of a matrix

- ▶ We can get the inverse of a square matrix by using `inv()` function in `numpy.linalg` module



Eigen values and Eigen vectors

Given a square matrix A



Eigen values and Eigen vectors

Given a square matrix A

- ▶ **$\text{eig}(A)[0]$ gives its eigen values**



Eigen values and Eigen vectors

Given a square matrix A

- ▶ $\text{eig}(A)[0]$ gives its eigen values
- ▶ $\text{eig}(A)[1]$ gives its eigen vector



Eigen values and Eigen vectors

Given a square matrix A

- ▶ `eig(A)[0]` gives its eigen values
- ▶ `eig(A)[1]` gives its eigen vector
- ▶ **`eigvals(A)` gives its eigen values**



Eigen values and Eigen vectors

Given a square matrix A

- ▶ **`eig(A)[0]` gives its eigen values**
- ▶ **`eig(A)[1]` gives its eigen vector**
- ▶ **`eigvals(A)` gives its eigen values**



Eigen values and Eigen vectors

Given a square matrix A

- ▶ `eig(A)[0]` gives its eigen values
- ▶ `eig(A)[1]` gives its eigen vector
- ▶ `eigvals(A)` gives its eigen values

`eig` and `eigvals` functions are present in `numpy.linalg` module



Summary

- ▶ Create matrices using arrays
- ▶ Add, subtract and multiply matrices
- ▶ Take scalar multiple of a matrix
- ▶ Use the function `det()` to find the determinant of a matrix



Summary

- ▶ Find out the inverse of a matrix, using the function `inv()`
- ▶ Find out the eigen vectors and eigen values of a matrix, using functions `eig()` and `eigvals()`



Evaluations

1. A and B are two matrix objects of appropriate sizes. Matrix multiplication is done by

- ▶ **`A * B`**
- ▶ **`multiply(A, B)`**
- ▶ **`mul(A, B)`**
- ▶ **`element_multiply(A, B)`**



Evaluations

1. `eig(A) [1]` and `eigvals(A)` are the same
- ▶ True
 - ▶ False



Solutions

1. **A * B**

2. **False**



Forum to answer questions

- ▶ Do you have questions in **THIS Spoken Tutorial?**
- ▶ Choose the minute and second where you have the question.
- ▶ Explain your question briefly.
- ▶ Someone from the **FOSSEE** team will answer them. Please visit

<http://forums.spoken-tutorial.org/>



Forum to answer questions

- ▶ Questions not related to the Spoken Tutorial?
- ▶ Do you have general / technical questions on the Software?
- ▶ Please visit the FOSSEE Forum
<http://forums.fossee.in/>
- ▶ Choose the Software and post your question.



Textbook Companion Project

- ▶ The FOSSEE team coordinates coding of solved examples of popular books
- ▶ We give honorarium and certificate to those who do this

For more details, please visit this site:

<http://tbc-python.fossee.in/>



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- ▶ **Spoken Tutorial Project is a part of the Talk to a Teacher project**
- ▶ **It is supported by the National Mission on Education through ICT, MHRD, Government of India**
- ▶ **More information on this mission is available at:**

<http://spoken-tutorial.org/NMEICT-Intro>



THANK YOU!

For more information, visit our website
<http://fossee.in/>

