Vectors: Takeaways

Syntax

- Visualizing vectors in matplotlib:

```
import matplotlib.pyplot as plt
plt.quiver(0, 0, 1, 2)
```

- Setting the color of each vector:

```
plt.quiver(0, 0, 1, 2, angles='xy', scale_units='xy', scale=1, color='blue')
```

- Multiplying and adding vectors:

```
vector_one = np.asarray([
[1],
[2],
[1]
], dtype=np.float32)
vector_two = 2*vector_one + 0.5*vector_one
```

- Computing the dot product:

```
vector_dp = np.dot(vector_one[:,0], vector_two)
```

Concepts

- When referring to matrices, the convention is to specify the number of rows first then the number of columns. For example, a matrix containing two rows and three columns is known as a $2x3$ matrix.
- A list of numbers in a matrix is known as a vector, a row from a matrix is known as a row vector, and a column from a matrix is known as a column vector.
- A vector can be visualized on a coordinate grid when a vector contains two or three elements. Typically, vectors are drawn from the origin $(0, 0)$ to the point described by the vector.
- Arrows are used to visualize individual vectors because they emphasize two properties of a vector — direction and magnitude. The direction of a vector describes the way it's pointing while the magnitude describes its length.
- The `pyplot.quiver()` function takes in four required parameters: `X` , `Y` , `U` , and `V` . `X` and `Y` correspond to the (x, y) coordinates we want the vector to start at while `U` and `V` correspond the (x, y) coordinate we want to draw the vector from.
- The optional parameters: `angles` , `scale_units` and `scale` always want to be used when plotting vectors. Setting angles to `'xy'` lets matplotlib know we want the angle of the vector to be between the points we specified. The `scale_units` and `scale` parameters lets us specify custom scaling parameters for the vectors.
- Similar to rows in a matrix, vectors can be added or subtracted together. To add or subtract vectors, you add the corresponding elements in the same position. Vectors can also by scaled up by multiplying the vector by a real number greater than 1 or less than -1. Vectors can also be scaled down by multiplying the vector by a number between -1 and 1.

- To compute the dot product, we need to sum the products of the 2 values in each position in each vector. The equation to compute the dot product is:
$$\vec{a} * \vec{b} = \sum_{i=1}^{n} a_i b_i = a_1 b_1 + a_2 b_2 + ... + a_n b_n$$
where a and b are vectors.
- A linear combination are vectors that are scaled up and then added or subtracted.
- The arithmetic representation of the matrix equation is $A\vec{x} = \vec{b}$ where where A represents the coefficient matrix, $\vec{x}$ represents the solution vector, and $\vec{b}$ represents the constants. Note that $\vec{b}$ can't be a vector containing all zeros, also known as the zero factor and represented using 0.

Resources

- [Vector operations]
- [plt.quiver()]