Column and Row pictures

Mitaxi Mehta: Lecture 5

- If you are to design an alogorithm to plot a line, how will you calculate the coordinates of the points? Example $y = 4x + 5$.

- If you are to design an alogorithm to plot a line, how will you calculate the coordinates of the points? Example $y = 4x + 5$.
- Choose whichever value of x you wish and calculate the corresponding y values.

- If you are to design an alogorithm to plot a line, how will you calculate the coordinates of the points? Example $y = 4x + 5$.
- Choose whichever value of x you wish and calculate the corresponding y values.
- One could as well choose various y values and calculate the corresponding x coordinates.

- If you are to design an alogorithm to plot a line, how will you calculate the coordinates of the points? Example $y = 4x + 5$.

- Choose whichever value of x you wish and calculate the corresponding y values.

- One could as well choose various y values and calculate the corresponding x coordinates.

- The variable that can take any arbitrary value on a chosen interval is called a free variable. The variable whose value depends on the free variables is called the dependent variable.

- An equation of a line has one free variable, hence a line is a one dimensional object.

- An equation of a line has one free variable, hence a line is a one dimensional object.
- How can one identify points on the plane $2x + 4y + 3z = 5$?

- An equation of a line has one free variable, hence a line is a one dimensional object.
- How can one identify points on the plane $2x + 4y + 3z = 5$?
- Anjali: Plug-in (x, y) values to get z.

- An equation of a line has one free variable, hence a line is a one dimensional object.
- How can one identify points on the plane $2x + 4y + 3z = 5$?
- Anjali: Plug-in (x, y) values to get z.
- There are two free variables, plane is a two dimensional object.

- An equation of a line has one free variable, hence a line is a one dimensional object.
- How can one identify points on the plane $2x + 4y + 3z = 5$?
- Anjali: Plug-in (x, y) values to get z.
- There are two free variables, plane is a two dimensional object.
- The method works for nonliner equations too, one can draw the curve for $x \sin(y) + e^y \cos(y) = 10$ by inputting y values and calculating x, to generate the corresponding one dimensional curve.

Row space

- Row space of a matrix A, $R(A)$ constitutes of all possible vectors of the form, $c_1 R_1 \uparrow + c_2 R_2 \uparrow + ...$, where, $R1_1 \uparrow, R_2 \uparrow, ...$, are row vectors of the matrix and $c_1, c_2, ... \in R$.

Row space

- Row space of a matrix A, $R(A)$ constitutes of all possible vectors of the form, $c_1 R_1 \uparrow + c_2 R_2 \uparrow + ...$, where, $R1_1 \uparrow, R_2 \uparrow, ...$, are row vectors of the matrix and $c_1, c_2, ... \in R$.

- A set of equations representing two lines can also be written as, for example,

$$x \begin{pmatrix} 2 \\ 0 \end{pmatrix} + y \begin{pmatrix} 1 \\ 5 \end{pmatrix} = \begin{pmatrix} 3 \\ 5 \end{pmatrix}$$

- The above type of representation is known as the column picture.

- In column picture one aims to find the scaling coefficients x and y so that the vectors add up to the RHS.

- In column picture one aims to find the scaling coefficients x and y so that the vectors add up to the RHS.
- As opposed to the row picture where one aims to find the intersection point of given lines.

- In column picture one aims to find the scaling coefficients x and y so that the vectors add up to the RHS.
- As opposed to the row picture where one aims to find the intersection point of given lines.
- The row picture and the column picture are useful for higher dimensions too.

- Consider the matrix equation,

$$\begin{pmatrix} 1 & 2 & 3 \\ 1 & 1 & 2 \\ 2 & 1 & 4 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 3 \\ 2 \\ 4 \end{pmatrix}$$

- Consider the matrix equation,

$$\begin{pmatrix} 1 & 2 & 3 \\ 1 & 1 & 2 \\ 2 & 1 & 4 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 3 \\ 2 \\ 4 \end{pmatrix}$$

- In row picture it translates to three intersection planes.

- Consider the matrix equation,

$$\begin{pmatrix} 1 & 2 & 3 \\ 1 & 1 & 2 \\ 2 & 1 & 4 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 3 \\ 2 \\ 4 \end{pmatrix}$$

- In row picture it translates to three intersection planes.
- In column picture it translates to sum of three vectors.

- Consider the matrix equation,

$$\begin{pmatrix} 1 & 2 & 3 \\ 1 & 1 & 2 \\ 2 & 1 & 4 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 3 \\ 2 \\ 4 \end{pmatrix}$$

- In row picture it translates to three intersection planes.
- In column picture it translates to sum of three vectors.
- When $Det(A) = 0$, A is called a singular matrix.

Excercises

- Solve section 1.3 problem 1 from Strang.

Excercises

- Solve section 1.3 problem 1 from Strang.
- Change one of the coefficients in the above problem and solve again.

Excercises

- Solve section 1.3 problem 1 from Strang.
- Change one of the coefficients in the above problem and solve again.
- Solve section 1.3 problem 3 from Strang.