Linearity Identifier (on matrices)

Determinants

- A ***determinant*** is a special number calculated from a square matrix that reveals properties about the matrix, acting as a scaling factor for area/volume in transformations and indicating if a matrix is invertible.
- The formula to solve for determinant of a 2x2 matrix:

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} = ad - bc$$

```
matrix_2x2 = randi([-10,10],2,2)
```

```
matrix_2x2 = 2×2
     0    -9
    -2    -5
```

```
determinant = (matrix_2x2(1,1).*matrix_2x2(2,2))-(matrix_2x2(1,2).*matrix_2x2(2,1))
```

```
determinant =
-18
```

```
if determinant == 0
    disp("it is linear")
else
    disp("not linear")
end
```

```
not linear
```

- The formula to solve for determinant of a 3x3 matrix:

$$\begin{bmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{bmatrix} = a_1 \begin{bmatrix} b_2 & c_2 \\ b_3 & c_3 \end{bmatrix} - b_1 \begin{bmatrix} a_2 & c_2 \\ a_3 & c_3 \end{bmatrix} + c_1 \begin{bmatrix} a_2 & b_2 \\ a_3 & b_3 \end{bmatrix}$$

```
matrix_3x3 = randi([-20,20],3,3)
```

```
matrix_3x3 = 3×3
   -15    -3    18
   -13   -18     0
   -11    17     0
```

```
a1_matrix = (matrix_3x3(2,2).*matrix_3x3(3,3))-(matrix_3x3(3,2).*matrix_3x3(2,3));
b1_matrix = (matrix_3x3(2,1).*matrix_3x3(3,3))-(matrix_3x3(3,1).*matrix_3x3(2,3));
c1_matrix = (matrix_3x3(2,1).*matrix_3x3(3,2))-(matrix_3x3(3,1).*matrix_3x3(2,2));
determinant = (matrix_3x3(1,1).*a1_matrix) - (matrix_3x3(1,2).*b1_matrix) +
(matrix_3x3(1,3).*c1_matrix)
```

```
determinant =
-7542
```

```
if determinant == 0
    disp("it is linear")
else
    disp("not linear")
end
```

```
not linear
```