CS 436/536 Assignment-5

Description:

Generative Adversarial Network (GAN)

$$y = 3x + 1$$
$$y = 5x^2 + 3x + 1$$
$$y = 7x^3 + 5x^2 + 3x + 1$$

1. Create 3 GAN models to be trained on 3 types of datasets. (Three different polynomial equations)
2. When a GAN model is being trained, your generator should try to generate data of a polynomial equation.
3. Your discriminator should try to discriminate the data produced by your generator and real data generated by equations above.
4. Use the following code snippet to produce data: (always use batch_s = 256)

```
# We want to teach a Machine learning model the following sample equation:  7x^2 + 2x +

def functions(x):
    return  7*x*x + 2*x + 1 #Chnage this equation as per your need

def data_generation():
    'This function generates the data of batch size = batch_s'
    data = []
    x = 20 * randn(batch_s) # random inputs
    for i in range(batch_s):
        y = functions(x[i])
        data.append([x[i], y]) # dataset
    return torch.FloatTensor(data)
```

5. After training the GAN use the trained generator to generate fake samples. Once you have fake samples, plot real (total 5000) and fake samples (total 5000) for each case.

Submission:

1. Due date is midnight of 1 Dec 2024 . The total points will be reduced by 5% for each day after the due date.
2. Submission in a single PDF file. Include all the code with comments, plots, and summary.

You will be making 3 models in total and for each following is the score breakdown. [3x30 = 90 Points]

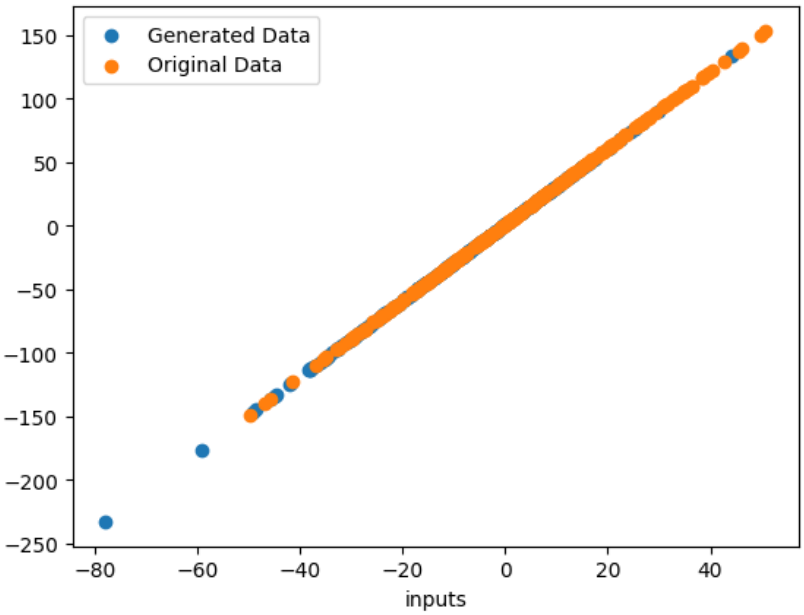
1. Generate the real data for each equation and plot it. [2 Points].
2. Create a GAN model with a Generator and Discriminator. (Do not use any built-in GAN library, make your GAN using only fundamental pytorch and python functions.) [10 points]

3. Train your generator and discriminator to produce their expected behavior. [7 points]
4. After training the GAN use the trained generator to generate fake samples. Once you have fake samples, plot real (total 5000) and fake samples (total 5000). [10 points]

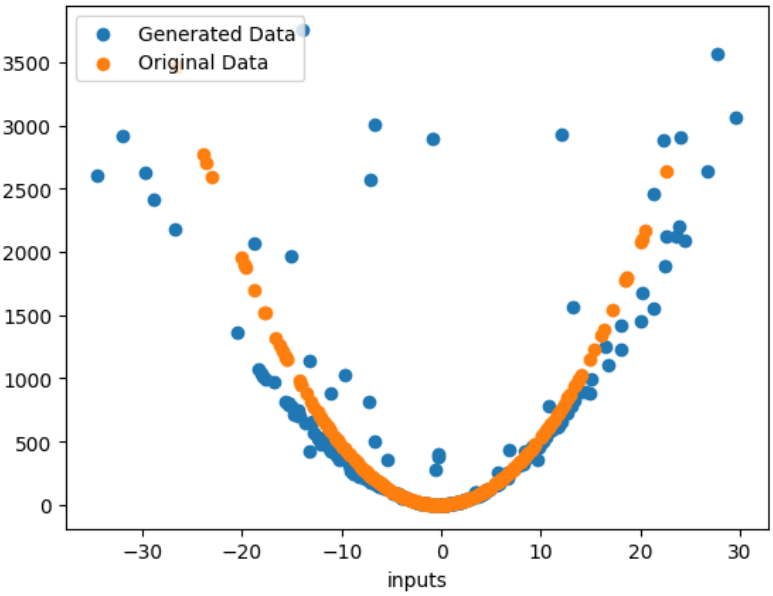
Write a summary explaining your results and observations. Which one do you think performs the best and why? [10 points].

In your plot your original data and generated data should follow the natural behavior of the given Linear, Quadratic and Cubic polynomials. For example, your plots for Original Data and Generated Data should look (not exact) similar to this:

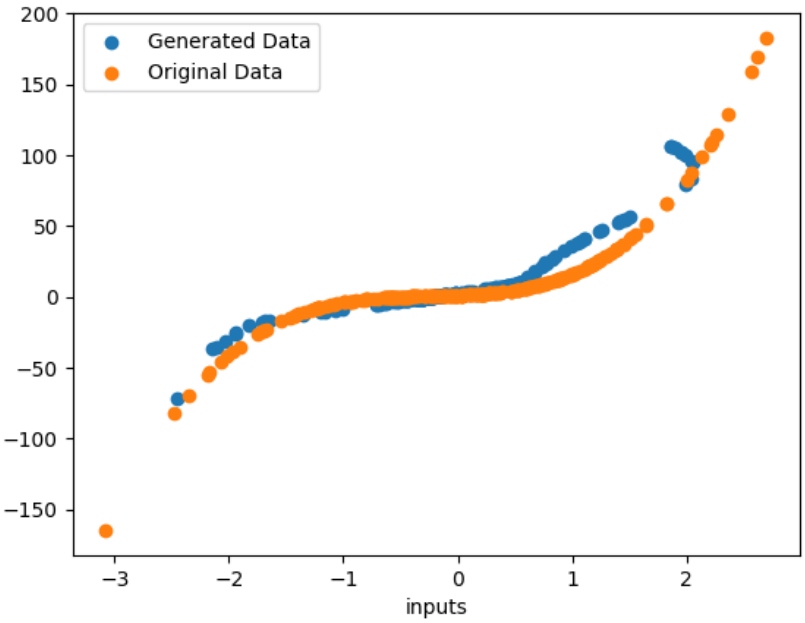
Liner:



Quadratic:



Cubic:



Note:

1. It is important that everyone submits their entire notebook code in PDF format as well merged to the report. If this is not done points will be deducted.
2. Feel free to provide links to your notebook in your report as well.
3. Review and follow these Watson College Academic Honesty policies that spell out the consequences of academic dishonesty.
4. Do not copy/give code from/to others. If plagiarism is found, both will receive zero points.
5. You can submit multiple times before the due date, only the last submission will be graded.

Important Notes:

Make a report first answering all the questions individually. For example, if a question is asking you to show a plot, copy your plot from your notebook and paste it in your report with the question. If a question is asking you to report the final accuracy, please put the values in the report with the question.

After the report is done, then merge a pdf of your notebook to the bottom of your report. Please submit only a single PDF file.