Assignment 01

Deep Learning Essentials

Instructions:

Answer the following questions based on the concepts covered in the lectures. Use external resources to research (i.e. Google) to explore and expand your understanding. Each question should be answered in **150–200 words**.

Question 1: Exploring Neural Network Architectures

In the lecture on Neural Networks, we learned about fully connected neural networks and their application in house price prediction. However, there are more advanced neural network architectures beyond fully connected networks. Research and describe **two advanced neural network models** (e.g., Convolutional Neural Networks, Recurrent Neural Networks, or Transformers). Explain their unique features, how they differ from fully connected networks, and provide one real-world application for each.

Question 2: Beyond Sigmoid: Activation Functions in Neural Networks

The lecture on Logistic Regression introduced the sigmoid function as a key component for binary classification. However, there are many other activation functions used in neural networks. Research and describe **two additional activation functions** (e.g., ReLU, Tanh, or Leaky ReLU). Explain how they work, their advantages over the sigmoid function, and in what scenarios they are commonly used.

Question 3: Exploring Loss Functions

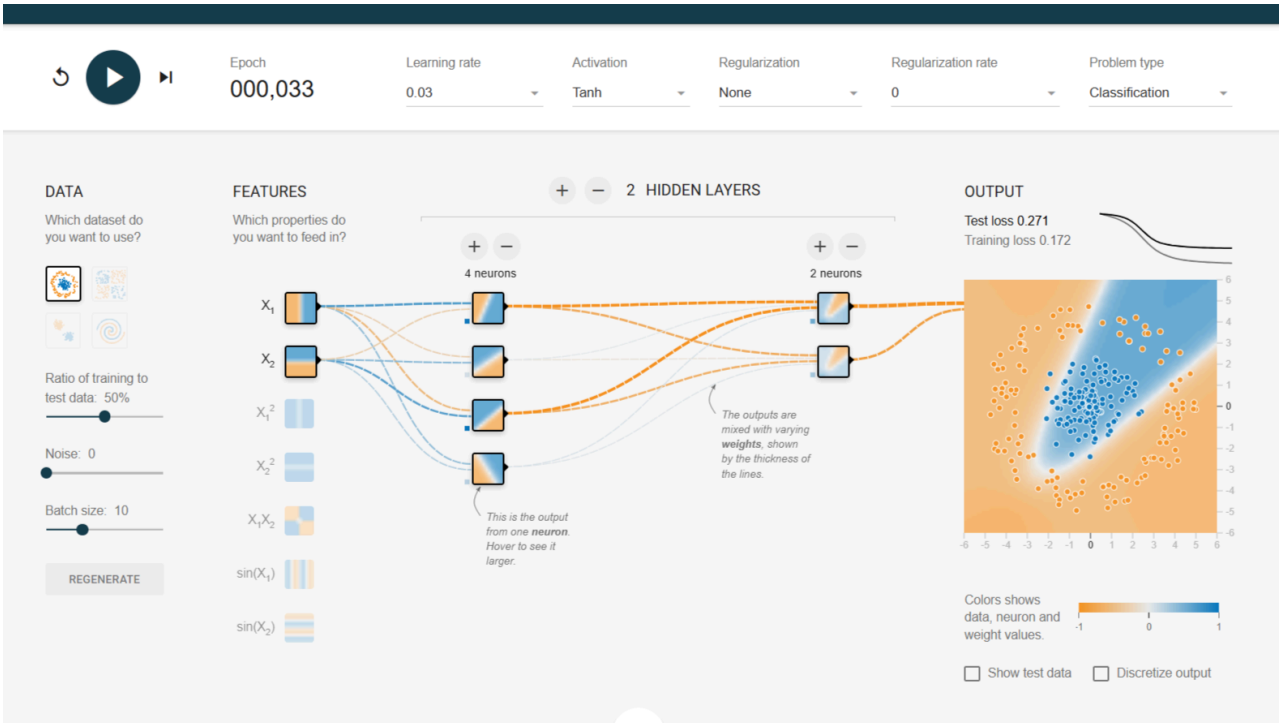
In the lecture on Loss Functions, we discussed the negative log loss (binary cross-entropy) as a common loss function for binary classification. However, different tasks require different loss functions. Research and describe **two other**

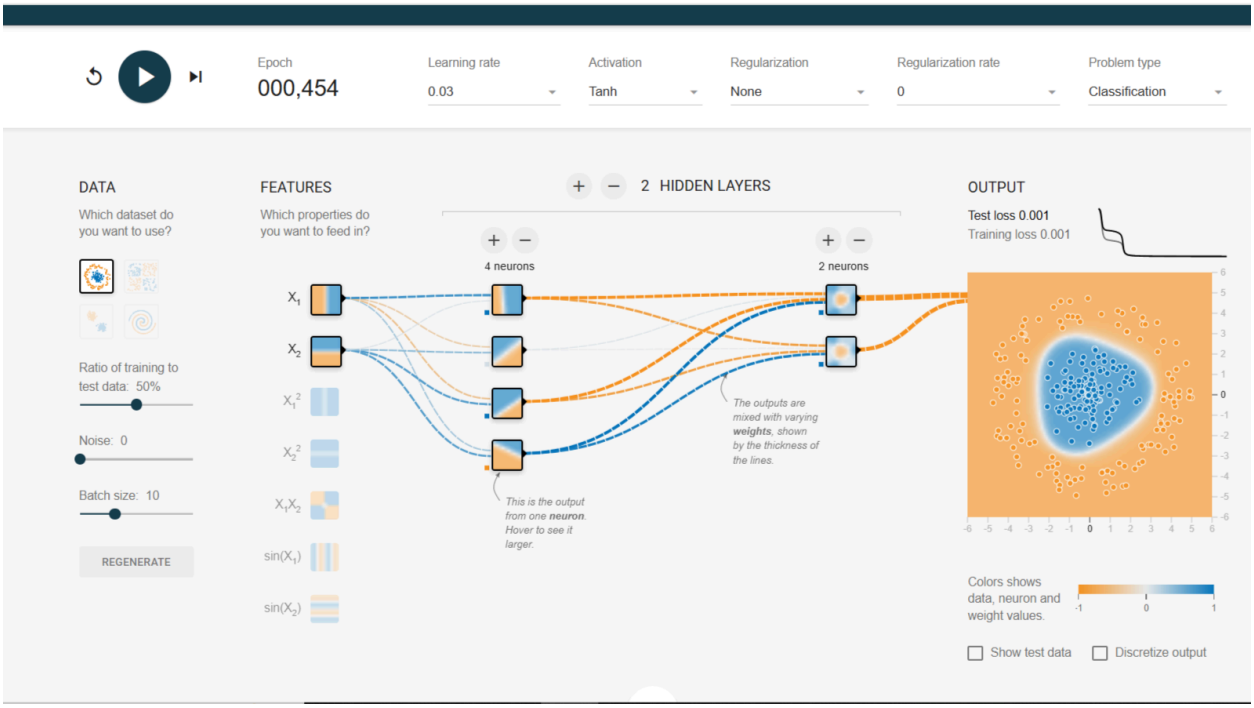
loss functions (e.g., Mean Squared Error, Hinge Loss, or Cross-Entropy Loss for multi-class classification). Explain their mathematical formulation, the type of problems they are used for, and why they are suitable for those tasks.

Bonus Activity: Interactive Practice

Visit the TensorFlow Playground (https://playground.tensorflow.org/)and experiment with building a simple neural network. Try changing the activation functions, adding layers, and observing how the model learns. Write a short reflection (50–100 words) on how changing these parameters affects the model's performance.

TensorFlow Playground





Submission Guidelines:

- Submit your answers in a PDF document.
- Include references for any external resources you used.
- The bonus activity reflection can be included at the end of your document.

Grading Criteria

Each question is worth **10 marks**, and the assignment is graded out of a total of **30 marks**. The grading will be based on the following criteria:

1. **Accuracy and Depth of Explanation (4 marks):**
    - The answer should accurately explain the concepts and provide sufficient depth.
    - Use of relevant examples or applications to support the explanation.
2. **Clarity and Organization (3 marks):**
    - The answer should be well-structured, clear, and easy to follow.
    - Proper use of paragraphs, headings, and bullet points (if applicable).
3. **Research and Exploration (2 marks):**

    - Evidence of research beyond the lecture content.
    - Use of credible external resources to enhance the explanation.
4. **Originality and Reflection (1 mark):**
    - The answer should demonstrate original thought and personal reflection.
    - Avoid copying directly from sources; paraphrase and synthesize information.

Total Marks: 30

- **Question 1: 10 marks**
- **Question 2: 10 marks**
- **Question 3: 10 marks**

The bonus activity is optional and does not contribute to the grading but is highly recommended for a better understanding of the concepts.

Good luck!