13 June2024

**Final Evaluation**

The project test consists of 5 problems, for which a brief written report with pictures and a brief explanation of the results should be provided. The student will explain his/her results in written form together **with their codes** to [esteban@uidaho.edu](mailto:esteban@uidaho.edu)

**Deadline: June 22, 2024**

**Remark:** Provide a brief reasoning in the report why you choose certain algorithm. Please provide in your report full name and **matriculate number**.

**Problem 1**. Using the data set called „problem1.csv (x\_training, y\_training)“ :

1. Find the polynomial that fits the best training data
2. Using the AIC criteria, find the best polynomial that can fit the data.
3. Cross validate the polynomial with the data set called “problem1.csv (x\_test, y\_test)”

**Problem 2**. From a clinical trial, we have 12 patients with HIV infection. After treatment, the disease progressed in 6 patients (1) and in 6 patients the infection did not progress (0). Four measurements are taken in the 12 patients (Age, sugar levels, T cell levels, and Cholesterol). Which measurement can be used as a marker to describe the progression of the disease? Which will be the criteria to predict the progression? The data can be found in „problem2.csv (x\_age, x\_sugar, x\_Tcell, x\_cholesterol, outcome). Arrange the data and briefly explain your results. The variable “y” (target) is a vector of 0 and 1 to represent the progression.

**Problem 3.** Having the following logic table

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Using Keras, construct an **&** and **$** operator gate with a simple perceptron. If A=[1.001 0 0.001 1], B=[0 1 0 1] and C=[0 1 1 0]. Compute the operation (A&B)$C with the perceptron.

**Problem 4**. Using a multilayer perceptron with Keras produce a GEOMETRIC FORM with the dimension of your election. **Remark:** In other words, use the equation of ANY GEOMETRIC FORM (**except the TORUS**), then generate artificial data to generate X, Y and Z. Then you use data of X, Y Z to train a Neural Network, and then form the shape of the selected form but produced by the Neural Network. In your report you should mention the equation of the geometric form you selected, and the figures generated by the equation and by your neural network.

**Problem 5**. The third problem is flexibility.

The student should make an assay of 500 words of one of the following papers

* Li *et al.* 2020. Accurate data-driven prediction does not mean high reproducibility
* LeCun\_2015\_Deep learning