README OF MULTIPLE POLYNOMIAL EQUATION SYSTEM DATABASES THAT WERE GENERATED

made by: César Miranda Meza

email: cmirandameza3@hotmail.com

The multiple polynomial classification equation that was used as a reference to create the databases labeled as “the multiple polynomial classification equation systems” is the following:

$$y \in \begin{cases} 1 & if \quad b_0 + b_1 x_1 + b_2 x_1^2 + b_3 x_2 + b_4 x_2^2 < 30 \\ 0 & if \quad b_0 + b_1 x_1 + b_2 x_1^2 + b_3 x_2 + b_4 x_2^2 \geq 30 \end{cases} \tag{1}$$

Where y is the dependent variable (output of the current sample); x_1, x_2 represents the independent variables (inputs of the current sample); and b_0, b_1, b_2, b_3, b_4 stand for the coefficient values of the equation. Furthermore, the values that were selected for b_0, b_1, b_2, b_3, b_4 are the following:

- $b_0 = 82$
- $b_1 = -1.6$
- $b_2 = 0.016$
- $b_3 = -1.28$
- $b_4 = 0.0128$

such that the Eq. (1) will turn into the following:

$$y \in \begin{cases} 1 & if \quad 82 - (1.6)x_1 + (0.016)x_1^2 - (1.28)x_2 + (0.0128)x_2^2 < 30 \\ 0 & if \quad 82 - (1.6)x_1 + (0.016)x_1^2 - (1.28)x_2 + (0.0128)x_2^2 \geq 30 \end{cases} \tag{2}$$

However, the Eq. (2) was modified by adding to it a bias component r, that would represent a random value and should be generated each time a new sample is calculated:

$$y \in \begin{cases} 1 & if \quad 82 - (1.6)x_1 + (0.016)x_1^2 - (1.28)x_2 + (0.0128)x_2^2 + r < 30 \\ 0 & if \quad 82 - (1.6)x_1 + (0.016)x_1^2 - (1.28)x_2 + (0.0128)x_2^2 + r \geq 30 \end{cases} \quad | \; -10 \leq r \leq 10 \tag{3}$$

Where the independent variable was restricted to be sampled with values according to the following way $0 < x \leq 100$ and where if no random bias value is needed, then it should be negated by setting $r = 0$ or, Ec. (2) should be used instead.

Nevertheless, several regression databases governed by the term $82 - (1.6)x_1 + (0.016)x_1^2 - (1.28)x_2 + (0.0128)x_2^2 + r$ from the Eq. (3) have already been created (see databases in the directory databases/regression/randMultiplePolynomialEquationSystem). Therefore, it was

decided to recycle them and use a copy of those files in Excel to apply to them the threshold defined in the Eq. (3), which is 30. As a consequence, the following .csv (comma delimited) files were generated for the creation of the multiple linear classification equation systems:

- randPolynomialEquationSystem/1systems_10samplesPerSys.csv
- randPolynomialEquationSystem/10systems_10samplesPerSys.csv
- randPolynomialEquationSystem/10systems_100samplesPerSys.csv
- randPolynomialEquationSystem/100systems_10samplesPerSys.csv
- randPolynomialEquationSystem/100systems_100samplesPerSys.csv

And for the ones made from the Eq. (2), which were created with the same strategy (see databases in the directory databases/regression/multiplePolynomialEquationSystem), the following .csv (comma delimited) files were generated:

- polynomialEquationSystem/1systems_10samplesPerSys.csv
- polynomialEquationSystem/10systems_10samplesPerSys.csv
- polynomialEquationSystem/10systems_100samplesPerSys.csv
- polynomialEquationSystem/100systems_10samplesPerSys.csv
- polynomialEquationSystem/100systems_100samplesPerSys.csv

For all these .csv files, note that they try to mimic how a real database would normally be organized by a professional and in which you will encounter four columns, whose headers and purpose are the following:

1. **id:** Represents the unique identifier for the current row of the database.
2. **system_id:** Represents the unique identifier for the current system sampled. This is because the databases will contemplate having several samples for several systems that manifest the same phenomenon.
3. **dependent_variable:** Represents the output value of the current sample.
4. **independent_variable_1:** Represents the input value 1 that generated the current sample.
5. **independent_variable_2:** Represents the input value 2 that generated the current sample.

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