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Assignment 1 Report

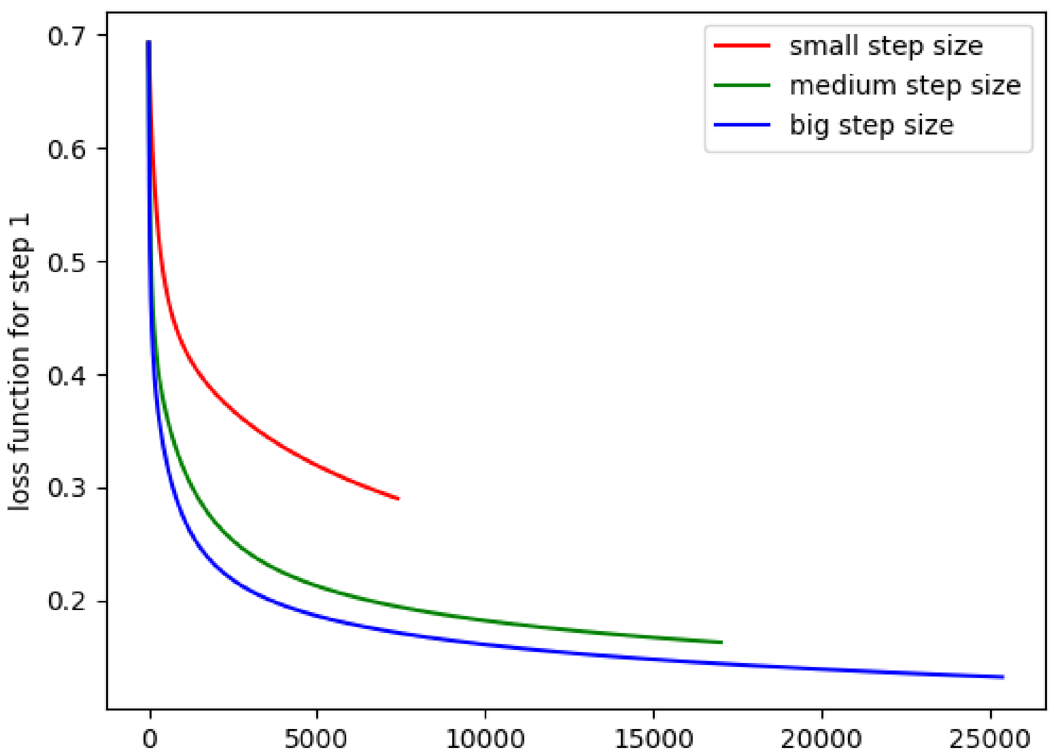
Part1

The program checks the part number and the step number with sys.argv[] and the step of the code can determine in this situation.

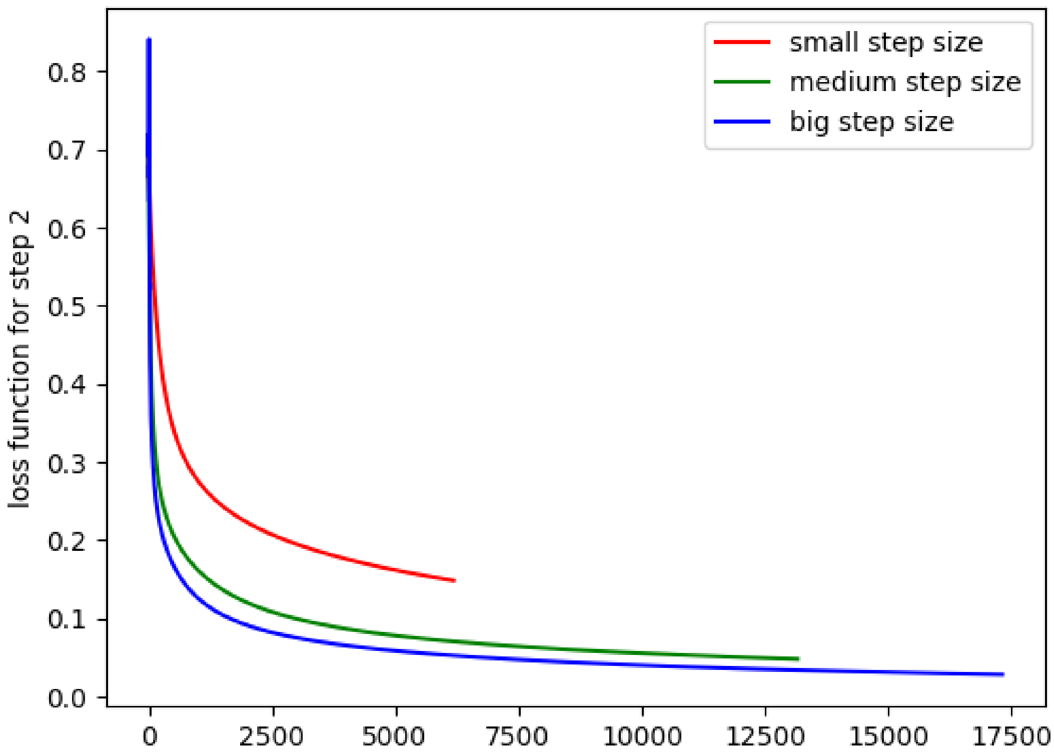
Firstly, I read the given data and I apply cross-validation with 5-fold on the data given. Then, in line with the step number given, I regulate the data and I split them as X and y, so I get the dataset I need. In there I apply normalization on X because normalization can handle with infinite numbers.

After that, I apply the algorithm of the equation of loss function on the dataset and logistic regression and I reach the results of loss function, the number of iterations of each step size for each step and the time I need for each step.

Loss Function of Step 1:



Loss Function of Step 2:



The number of iterations of each step size and the time I need for Step 1:

```
C:\Users\Yunus Kardaş\Desktop\ML Assignment 2>python assignment2.py part1 step1
Number of iteration of the step1 for small step size = 5302
Number of iteration of the step1 for medium step size = 24108
Number of iteration of the step1 for big step size = 32236
Time to complete step1: 574.8283724784851 sec
```

The number of iterations of each step size and the time I need for Step 1:

```
C:\Users\Yunus Kardaş\Desktop\ML Assignment 2>python assignment2.py part1 step2
Number of iteration of the step2 for small step size = 6686
Number of iteration of the step2 for medium step size = 14970
Number of iteration of the step2 for big step size = 21496
Time to complete step2: 85.5327398777008 sec
```

Part 2

GiveBirth	Yes	No
Mammal	6	1
Non-Mammal	1	12

P(GiveBith, Yes | Mammal) = 6/7

P(GiveBith, No | Mammal) = 1/7

P(GiveBith, Yes | Non-Mammal) = 1/13

P(GiveBith, No | Non-Mammal) = 12/13

P(GiveBith, Yes) = 7/20

P(GiveBith, No) = 13/20

CanFly	Yes	No
Mammal	1	6
Non-Mammal	3	10

P(CanFly, Yes | Mammal) = 1/7

P(CanFly, No | Mammal) = 6/7

P(CanFly, Yes | Non-Mammal) = 3/13

P(CanFly, No | Non-Mammal) = 10/13

P(CanFly, Yes) = 4 / 20

P(CanFly, No) = 16/20

LiveInWater	Yes	No	Sometimes
Mammal	2	5	0
Non-Mammal	3	6	4

P(LiveInWater, Yes | Mammal) = 2/7

P(LiveInWater, No | Mammal) = 5/7

P(LiveInWater, Sometimes | Mammal) = 0/7

P(LiveInWater, Yes | Non-Mammal) = 3/13

P(LiveInWater, No | Non-Mammal) = 6/13

P(LiveInWater, Sometimes | Non-Mammal) = 4/13

P(LiveInWater, Yes) = 5/20

P(LiveInWater, No) = 11/20

P(LiveInWater, Sometimes) = 4/20

HaveLegs	Yes	No
Mammal	5	2
Non-Mammal	9	4

P(HaveLegs, Yes | Mammal) = 5/7

P(HaveLegs, No | Mammal) = 2/7

P(HaveLegs, Yes | Non-Mammal) = 9/13

P(HaveLegs, No | Non-Mammal) = 4/13

P(HaveLegs, Yes) = 14/20

P(HaveLegs, No) = 6/20

P(Mammal | Test) = P(Test | Mammal) * P(Mammal) / P(Test)

P(Non-Mammal | Test) = P(Test | Non-Mammal) * P(Non-Mammal) / P(Test)

P(Test | Mammal) = P(GiveBith, Yes | Mammal) * P(CanFly, No | Mammal) *

P(LiveInWater, Yes | Mammal) * P(HaveLegs, No | Mammal)

= (6/7) * (6/7) * (2/7) * (2/7)

= 0.05998

P(Test | Non-Mammal) = P(GiveBith, Yes | Non-Mammal) * P(CanFly, No | Non-Mammal) *

P(LiveInWater, Yes | Non-Mammal) * P(HaveLegs, No | Non-Mammal)

= (1/13) * (10/13) *(3/13)*(4/13)

= 0.0042

P(Test) = P(GiveBith, Yes) * P(CanFly, No) * P(LiveInWater, Yes) * P(HaveLegs, No)

= (7/20) * (16/20) * (5/20) * (6/20)

= 0.021

P(Mammal) = 7/20 = 0.35

P(Non- Mammal) = 13/20 = 0.65

Therefore;

P(Mammal | Test) = 0.05998 * 0.35 / 0.021

= 0.99967

P(Non-Mammal | Test) = 0.0042 * 0.65 / 0.021

= 0.13

P(Mammal | Test) > P(Non-Mammal | Test)

So, the Test is much more likely to be a mammal than Non-Mammal.