Dieudonne_LogisticRegression.R

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```
#sigmoid=function(x)

sigmoid=function(x) {1/(1+exp(-x))} # A traditional sigmoid function

#I am currently exploring another function which will lead to lower MSE
#Such function could be like the one below
#a=2
#b=1
#c=2
#######################################################################
#sigmoid=function(x){a/(b+exp(-c*x))} # A proposed function
#######################################################################
###Fit logistic regression
fitLogist=function(x,y,intercept=T,tol=10e-5,max_it=100)
{
  ##Type conversion
  if (!is.matrix(x))
  {
    x=as.matrix(x)
  }
  if (!is.matrix(y))
  {
    y=as.matrix(y)
  }
  ##Add intercept is required
  if (intercept)
  {
    x=cbind(x,1)
  }
  ##Algorithm initialization
  iterations=0
  converged=F
  ##Weights are initialized to 1
  coeffs=matrix(1,dim(x)[2])

  ##Updates the weight until the max number of iter
  ##Or the termination criterion is met
  while (iterations<max_it& !converged)
  {
    iterations=iterations+1
    nu<-sigmoid(x %*% coeffs)
    old_pred=sigmoid(x %*% coeffs)
    nu_diag=diag(nu[,1])
```

```
    ##Weights update
    coeffs=coeffs + solve(t(x) %*% nu_diag %*% x)%*% t(x) %*% (y-nu)
    ##compute mse to check termination
    mse=mean((y-sigmoid(x%*%coeffs))^2)
    ##Stop computation if tolerance is reached
    if (mse<tol)
    {
      converged=T
    }

  }
  ##Creates the logit objects
  Logit=list(intercept=intercept)
  Logit[['coeffs']]=coeffs
  Logit[['preds']]=sigmoid(x%*%coeffs)
  Logit[['residuals']]=Logit[['preds']]-y
  Logit[['mse']]=mean(Logit[['residuals']]^2)
  Logit[['iteration']]=iterations
  attr(Logit, "class") <- "Logit"
  return(Logit)

}

##Predict the outcome on new data
predict.Logit<-function(Logit,x,probs=T,..)
{
  if (!is.matrix(x))
  {
    x=as.matrix(x)
  }
  if (Logit[['intercept']])
  {
    x=cbind(x,1)
  }
  if (probs)
  {
    sigmoid(x %*% Logit[['coeffs']])
  }
  else
  {
    sigmoid(x %*% Logit[['coeffs']])>0.5
  }
}



fitLogist(iris[,1:4],iris[,5]=='setosa')
```

```
## $intercept
```

```
## [1] TRUE
##
## $coeffs
##                    [,1]
## Sepal.Length   2.029730
## Sepal.Width    6.191345
## Petal.Length  -4.730761
## Petal.Width   -0.764520
##              -14.253843
##
## $preds
##                [,1]
##   [1,] 9.999832e-01
##   [2,] 9.994416e-01
##   [3,] 9.998486e-01
##   [4,] 9.991132e-01
##   [5,] 9.999889e-01
##   [6,] 9.999963e-01
##   [7,] 9.999068e-01
##   [8,] 9.999385e-01
##   [9,] 9.971452e-01
##  [10,] 9.995530e-01
##  [11,] 9.999957e-01
##  [12,] 9.998519e-01
##  [13,] 9.993664e-01
##  [14,] 9.995770e-01
##  [15,] 9.999999e-01
##  [16,] 1.000000e+00
##  [17,] 9.999994e-01
##  [18,] 9.999818e-01
##  [19,] 9.999965e-01
##  [20,] 9.999954e-01
##  [21,] 9.999297e-01
##  [22,] 9.999909e-01
##  [23,] 9.999962e-01
##  [24,] 9.996980e-01
##  [25,] 9.993880e-01
##  [26,] 9.988267e-01
##  [27,] 9.998850e-01
##  [28,] 9.999779e-01
##  [29,] 9.999745e-01
##  [30,] 9.993743e-01
##  [31,] 9.990517e-01
##  [32,] 9.999682e-01
##  [33,] 9.999995e-01
##  [34,] 9.999999e-01
##  [35,] 9.995175e-01
##  [36,] 9.999487e-01
##  [37,] 9.999953e-01
##  [38,] 9.999874e-01
```

```
##  [39,] 9.990405e-01
##  [40,] 9.999498e-01
##  [41,] 9.999861e-01
##  [42,] 9.393855e-01
##  [43,] 9.997217e-01
##  [44,] 9.999278e-01
##  [45,] 9.999674e-01
##  [46,] 9.992617e-01
##  [47,] 9.999932e-01
##  [48,] 9.997023e-01
##  [49,] 9.999948e-01
##  [50,] 9.999288e-01
##  [51,] 2.824107e-02
##  [52,] 2.010516e-02
##  [53,] 4.572818e-03
##  [54,] 1.557423e-04
##  [55,] 1.314334e-03
##  [56,] 4.849818e-04
##  [57,] 1.106424e-02
##  [58,] 2.944207e-03
##  [59,] 3.477015e-03
##  [60,] 1.496828e-03
##  [61,] 1.180028e-04
##  [62,] 8.833120e-03
##  [63,] 2.909508e-04
##  [64,] 7.294489e-04
##  [65,] 4.940354e-02
##  [66,] 3.398842e-02
##  [67,] 1.171238e-03
##  [68,] 2.663585e-03
##  [69,] 2.798652e-05
##  [70,] 1.229485e-03
##  [71,] 1.428190e-03
##  [72,] 1.150228e-02
##  [73,] 3.310849e-05
##  [74,] 4.577534e-04
##  [75,] 9.519801e-03
##  [76,] 1.522816e-02
##  [77,] 1.012934e-03
##  [78,] 8.805323e-04
##  [79,] 1.419877e-03
##  [80,] 1.966477e-02
##  [81,] 8.675571e-04
##  [82,] 1.502032e-03
##  [83,] 5.869105e-03
##  [84,] 2.234374e-05
##  [85,] 7.807549e-04
##  [86,] 2.829014e-02
##  [87,] 7.822978e-03
##  [88,] 1.190709e-04
```

```
##  [89,] 8.983749e-03
##  [90,] 5.370495e-04
##  [91,] 1.623488e-04
##  [92,] 2.171245e-03
##  [93,] 1.976642e-03
##  [94,] 1.943870e-03
##  [95,] 8.808049e-04
##  [96,] 7.413844e-03
##  [97,] 3.711683e-03
##  [98,] 6.363695e-03
##  [99,] 3.055753e-02
## [100,] 3.208911e-03
## [101,] 1.199548e-05
## [102,] 1.183729e-05
## [103,] 2.069280e-05
## [104,] 1.142108e-05
## [105,] 9.102813e-06
## [106,] 2.081601e-06
## [107,] 1.099664e-05
## [108,] 3.169794e-06
## [109,] 8.391829e-07
## [110,] 2.974746e-04
## [111,] 1.002543e-03
## [112,] 1.553254e-05
## [113,] 7.467291e-05
## [114,] 4.164701e-06
## [115,] 1.500114e-05
## [116,] 2.527913e-04
## [117,] 5.108944e-05
## [118,] 2.083984e-04
## [119,] 4.448701e-08
## [120,] 1.751412e-06
## [121,] 1.051379e-04
## [122,] 3.495705e-05
## [123,] 4.971909e-07
## [124,] 9.079872e-05
## [125,] 1.516111e-04
## [126,] 6.852921e-05
## [127,] 2.209094e-04
## [128,] 3.875348e-04
## [129,] 5.989145e-06
## [130,] 5.962389e-05
## [131,] 4.988841e-06
## [132,] 1.504525e-03
## [133,] 5.548331e-06
## [134,] 8.235110e-05
## [135,] 1.612731e-06
## [136,] 2.330261e-05
## [137,] 1.595365e-04
## [138,] 7.745622e-05
```

```
## [139,] 5.076481e-04
## [140,] 2.726266e-04
## [141,] 5.608482e-05
## [142,] 9.665499e-04
## [143,] 1.183729e-05
## [144,] 3.332205e-05
## [145,] 1.116703e-04
## [146,] 2.162266e-04
## [147,] 1.519435e-05
## [148,] 1.812309e-04
## [149,] 3.620208e-04
## [150,] 1.002828e-04
##
## $residuals
##                 [,1]
##   [1,] -1.684364e-05
##   [2,] -5.583858e-04
##   [3,] -1.514201e-04
##   [4,] -8.867670e-04
##   [5,] -1.110969e-05
##   [6,] -3.708627e-06
##   [7,] -9.316282e-05
##   [8,] -6.150462e-05
##   [9,] -2.854779e-03
##  [10,] -4.470414e-04
##  [11,] -4.262577e-06
##  [12,] -1.481237e-04
##  [13,] -6.336495e-04
##  [14,] -4.229879e-04
##  [15,] -7.145797e-08
##  [16,] -3.543418e-08
##  [17,] -5.589811e-07
##  [18,] -1.818185e-05
##  [19,] -3.470939e-06
##  [20,] -4.554475e-06
##  [21,] -7.034161e-05
##  [22,] -9.131155e-06
##  [23,] -3.771274e-06
##  [24,] -3.020345e-04
##  [25,] -6.120489e-04
##  [26,] -1.173345e-03
##  [27,] -1.150123e-04
##  [28,] -2.206673e-05
##  [29,] -2.553694e-05
##  [30,] -6.256632e-04
##  [31,] -9.482809e-04
##  [32,] -3.182187e-05
##  [33,] -4.979945e-07
##  [34,] -9.809259e-08
##  [35,] -4.825419e-04
```

```
##  [36,] -5.132424e-05
##  [37,] -4.660008e-06
##  [38,] -1.260807e-05
##  [39,] -9.595245e-04
##  [40,] -5.020680e-05
##  [41,] -1.387828e-05
##  [42,] -6.061447e-02
##  [43,] -2.783420e-04
##  [44,] -7.215750e-05
##  [45,] -3.261716e-05
##  [46,] -7.382594e-04
##  [47,] -6.771565e-06
##  [48,] -2.976628e-04
##  [49,] -5.221820e-06
##  [50,] -7.117638e-05
##  [51,]  2.824107e-02
##  [52,]  2.010516e-02
##  [53,]  4.572818e-03
##  [54,]  1.557423e-04
##  [55,]  1.314334e-03
##  [56,]  4.849818e-04
##  [57,]  1.106424e-02
##  [58,]  2.944207e-03
##  [59,]  3.477015e-03
##  [60,]  1.496828e-03
##  [61,]  1.180028e-04
##  [62,]  8.833120e-03
##  [63,]  2.909508e-04
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##  [68,]  2.663585e-03
##  [69,]  2.798652e-05
##  [70,]  1.229485e-03
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##  [73,]  3.310849e-05
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##  [75,]  9.519801e-03
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##  [77,]  1.012934e-03
##  [78,]  8.805323e-04
##  [79,]  1.419877e-03
##  [80,]  1.966477e-02
##  [81,]  8.675571e-04
##  [82,]  1.502032e-03
##  [83,]  5.869105e-03
##  [84,]  2.234374e-05
##  [85,]  7.807549e-04
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```
##  [86,]  2.829014e-02
##  [87,]  7.822978e-03
##  [88,]  1.190709e-04
##  [89,]  8.983749e-03
##  [90,]  5.370495e-04
##  [91,]  1.623488e-04
##  [92,]  2.171245e-03
##  [93,]  1.976642e-03
##  [94,]  1.943870e-03
##  [95,]  8.808049e-04
##  [96,]  7.413844e-03
##  [97,]  3.711683e-03
##  [98,]  6.363695e-03
##  [99,]  3.055753e-02
## [100,]  3.208911e-03
## [101,]  1.199548e-05
## [102,]  1.183729e-05
## [103,]  2.069280e-05
## [104,]  1.142108e-05
## [105,]  9.102813e-06
## [106,]  2.081601e-06
## [107,]  1.099664e-05
## [108,]  3.169794e-06
## [109,]  8.391829e-07
## [110,]  2.974746e-04
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## [115,]  1.500114e-05
## [116,]  2.527913e-04
## [117,]  5.108944e-05
## [118,]  2.083984e-04
## [119,]  4.448701e-08
## [120,]  1.751412e-06
## [121,]  1.051379e-04
## [122,]  3.495705e-05
## [123,]  4.971909e-07
## [124,]  9.079872e-05
## [125,]  1.516111e-04
## [126,]  6.852921e-05
## [127,]  2.209094e-04
## [128,]  3.875348e-04
## [129,]  5.989145e-06
## [130,]  5.962389e-05
## [131,]  4.988841e-06
## [132,]  1.504525e-03
## [133,]  5.548331e-06
## [134,]  8.235110e-05
## [135,]  1.612731e-06
```

```
## [136,]  2.330261e-05
## [137,]  1.595365e-04
## [138,]  7.745622e-05
## [139,]  5.076481e-04
## [140,]  2.726266e-04
## [141,]  5.608482e-05
## [142,]  9.665499e-04
## [143,]  1.183729e-05
## [144,]  3.332205e-05
## [145,]  1.116703e-04
## [146,]  2.162266e-04
## [147,]  1.519435e-05
## [148,]  1.812309e-04
## [149,]  3.620208e-04
## [150,]  1.002828e-04
##
## $mse
## [1] 7.762567e-05
##
## $iteration
## [1] 25
##
## attr(,"class")
## [1] "Logit"
```