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Data Mining HW 4
SVM

η (step size): 0.00001 has been determined empirically.

When η >= 0.0001, the weight vector *w* does not converge.

ε (convergence threshold): 0.0001 has been determined empirically.

w from gradient descent is close to *w* given from the closed form formula when ε <= 0.0001.

α = 100

```
w:
[[ 0.046  0.17  -0.2    0.413 -0.103 -0.392  0.551  0.25  -0.073 -0.111
  -0.049  0.008  0.294  0.072  0.01  -0.03   0.14  -0.258 -0.237 -0.085
  -0.045  0.023  0.082  0.037  0.023 -0.077 -0.006]]

η (step size): 1e-05
ε (convergence threshold): 0.0001
SSE on validation set:  1463.675
```

α = 200

```
w:
[[ 4.140e-02  1.717e-01 -1.864e-01  3.757e-01 -5.174e-02 -3.320e-01
   4.970e-01  2.310e-01 -7.658e-02 -1.019e-01 -6.335e-02  7.780e-03
   2.328e-01  6.210e-02  1.872e-04 -4.165e-02  1.250e-01 -2.457e-01
  -1.974e-01 -8.026e-02 -3.391e-02  1.759e-02  5.437e-02  3.485e-02
   2.219e-02 -5.436e-02 -6.294e-03]]

η (step size): 1e-05
ε (convergence threshold): 0.0001
SSE on validation set:  1453.361
```

α = 300

```
w:
[[ 0.038  0.173 -0.17   0.349 -0.022 -0.29   0.453  0.216 -0.077 -0.092
  -0.071  0.007  0.195  0.055 -0.005 -0.051  0.113 -0.235 -0.169 -0.077
  -0.025  0.014  0.037  0.033  0.021 -0.044 -0.006]]

η (step size): 1e-05
ε (convergence threshold): 0.0001
SSE on validation set:  1448.845
```

α = 400

```
w:
[[ 0.035  0.173 -0.154  0.328 -0.003 -0.258  0.417  0.204 -0.076 -0.084
  -0.075  0.007  0.17   0.05  -0.009 -0.057  0.103 -0.226 -0.149 -0.074
  -0.019  0.01   0.024  0.032  0.021 -0.037 -0.006]]

η (step size): 1e-05
ε (convergence threshold): 0.0001
SSE on validation set:  1447.466
```

α = 410

```
w:
[[ 0.035  0.173 -0.153  0.326 -0.001 -0.256  0.413  0.203 -0.076 -0.083
  -0.075  0.007  0.168  0.049 -0.009 -0.058  0.102 -0.225 -0.147 -0.074
  -0.019  0.01   0.022  0.032  0.021 -0.037 -0.006]]

η (step size): 1e-05
ε (convergence threshold): 0.0001
SSE on validation set:  1447.442
```

α = 419

```
w:
[[ 3.460e-02  1.729e-01 -1.517e-01  3.247e-01  1.735e-04 -2.531e-01
   4.106e-01  2.024e-01 -7.625e-02 -8.199e-02 -7.562e-02  6.640e-03
   1.659e-01  4.901e-02 -9.699e-03 -5.862e-02  1.008e-01 -2.240e-01
  -1.453e-01 -7.344e-02 -1.815e-02  9.742e-03  2.140e-02  3.165e-02
   2.077e-02 -3.644e-02 -6.261e-03]]

η (step size): 1e-05
ε (convergence threshold): 0.0001
SSE on validation set:  1447.434
```

α = 420

```
w:
[[ 3.458e-02  1.729e-01 -1.515e-01  3.245e-01  3.189e-04 -2.528e-01
   4.102e-01  2.023e-01 -7.623e-02 -8.191e-02 -7.564e-02  6.634e-03
   1.657e-01  4.896e-02 -9.727e-03 -5.868e-02  1.007e-01 -2.239e-01
  -1.451e-01 -7.342e-02 -1.811e-02  9.714e-03  2.129e-02  3.164e-02
   2.076e-02 -3.638e-02 -6.261e-03]]

η (step size): 1e-05
ε (convergence threshold): 0.0001
SSE on validation set:  1447.434
```

α = 421

```
w:
[[ 0.035  0.173 -0.151  0.324  0.    -0.253  0.41   0.202 -0.076 -0.082
  -0.076  0.007  0.165  0.049 -0.01  -0.059  0.101 -0.224 -0.145 -0.073
  -0.018  0.01   0.021  0.032  0.021 -0.036 -0.006]]

η (step size): 1e-05
ε (convergence threshold): 0.0001
SSE on validation set:  1447.435
```

α = 430

```
w:
[[ 0.034  0.173 -0.15   0.323  0.002 -0.25   0.407  0.201 -0.076 -0.081
  -0.076  0.007  0.164  0.049 -0.01  -0.059  0.1   -0.223 -0.143 -0.073
  -0.018  0.009  0.02   0.032  0.021 -0.036 -0.006]]

η (step size): 1e-05
ε (convergence threshold): 0.0001
SSE on validation set:  1447.442
```

α = 440

```
w:
[[ 0.034  0.173 -0.149  0.321  0.003 -0.248  0.404  0.2   -0.076 -0.08
  -0.076  0.007  0.162  0.048 -0.01  -0.06   0.099 -0.222 -0.142 -0.073
  -0.017  0.009  0.019  0.031  0.021 -0.036 -0.006]]

η (step size): 1e-05
ε (convergence threshold): 0.0001
SSE on validation set:  1447.465
```

α = 450

```
w:
[[ 0.034  0.173 -0.147  0.319  0.005 -0.245  0.401  0.199 -0.076 -0.08
  -0.076  0.006  0.16   0.048 -0.011 -0.06   0.098 -0.221 -0.14  -0.073
  -0.017  0.009  0.018  0.031  0.021 -0.035 -0.006]]

η (step size): 1e-05
ε (convergence threshold): 0.0001
SSE on validation set:  1447.501
```

α = 500

```
w:
[[ 0.033  0.173 -0.14   0.311  0.011 -0.233  0.386  0.194 -0.075 -0.076
  -0.077  0.006  0.151  0.046 -0.012 -0.063  0.094 -0.217 -0.133 -0.072
  -0.014  0.008  0.013  0.031  0.02  -0.033 -0.006]]

η (step size): 1e-05
ε (convergence threshold): 0.0001
SSE on validation set:  1447.870
```

$ python3 Assign4.py energydata_complete.csv 420 0.00001 0.0001 10000

```
w:
[[ 3.458e-02  1.729e-01 -1.515e-01  3.245e-01  3.189e-04 -2.528e-01
   4.102e-01  2.023e-01 -7.623e-02 -8.191e-02 -7.564e-02  6.634e-03
   1.657e-01  4.896e-02 -9.727e-03 -5.868e-02  1.007e-01 -2.239e-01
  -1.451e-01 -7.342e-02 -1.811e-02  9.714e-03  2.129e-02  3.164e-02
   2.076e-02 -3.638e-02 -6.261e-03]]

η (step size): 1e-05
ε (convergence threshold): 0.0001
SSE on test set:  177214.386
```