CS 8725: Report for assignment 3

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The Matlab code for all experiments is in the **Appendix** section.

Appendix:

assignment_3.m

```
clc;
clear all;
close all;

problem_1
problem_2
```

problem_1.m

```
% Load data
x = [1.47 1.5 1.52 1.55 1.57 1.6 1.63 1.65 1.68 1.7 1.73 1.75 1.78 1.8 1.83]';
y = [52.21 53.12 54.48 55.84 57.2 58.57 59.93 61.29 63.11 64.47 66.28 68.1 69.92 72.19 74.46]';

% Linear regression
A = [ones(length(x), 1) x];
Beta = (A'*A)\A'*y;

% Evaluation
prediction = A*Beta;
expected_loss_beta = (y-prediction)' * (y-prediction) / length(y);
display(expected_loss_beta);

% Polynomial regression
A = [A x.^2];
Beta_2 = (A'*A)\A'*y;

% Evaluation
prediction = A*Beta_2;
expected_loss_beta2 = (y-prediction)' * (y-prediction) / length(y);
display(expected_loss_beta2);

% Plot
figure;
scatter(x, y); hold on;
x_value = linspace(1.3, 2);
plot(x_value, Beta(1) + Beta(2)*x_value, 'r');
plot(x_value, Beta_2(1) + Beta_2(2)*x_value + Beta_2(3)*x_value.^2, 'g');
hold off;
title('Plot of data and regression lines');
xlabel('Height');
ylabel('Weight');
legend('Data', 'Linear regression', 'Polynomial regression');
```

problem_2.m

```
% Load data
[x1,x2,x3,x4] = textread('iris.data', '%f,%f,%f,%f,%*s');
X = [ones(length(x1),1) x1 x2 x3 x4];

setosa = 1:50;
versicolor = 51:100;
[~, d] = size(X);
y = [zeros(length(setosa),1); ones(length(versicolor),1)];

% Logistic regression gradient ascent
% initialize weight = [-1, 1]
W = 2*rand(d, 1)-1;
display(W);
% maximum iteration
T = 100000;
% learning rate
alpha = 0.001;
% conditional log likelihood
lw = zeros(1, T);

for t=1:T
    prediction = exp(X*W) ./ (1+exp(X*W));
    W = W + alpha * X' * (y - prediction);
    lw(t) = y'*X*W - sum( log(1+exp(X*W)) );
```

```
    if t > 1
        delta_lw = abs( (lw(t) - lw(t-1)) / lw(t-1) );
        % convergence criterion = percentage change < 0.03%
        if delta_lw < 3e-4
            break;
        end
    end
end

% Evaluation
classification = X*W > 0;
accuracy = sum(classification == y) / length(y);
display(accuracy);

% Plot of conditional log likelihood
figure;
plot(1:t, lw(1:t));
title(['Conditional log likelihood score (finish at t=' num2str(t) ')']);
xlabel('Iterations');
ylabel('l(w)');
```