CS2180: Artificial Intelligence Lab 8: Linear and Logistic Regression

February 26, 2020

Q1) Gradient Descent in 2D: Let $x \in \mathbb{R}^2$. Consider the functions $f_1(w) = w(1)^2 + w(2)^2 + 5w(1) - 3w(2) - 2$ and $f_2(w) = 10w(1)^2 + w(2)^2$
a) Show the gradient and contour plots for f_1 and f_2 [25Marks]
b) Perform gradient descent to find the minimum of f_1 and f_2. [25 Marks]

Q2) Data in the file *linear* is given in the form $(x^i, y^i)_{i=1}^n$, where $x^i \in \mathbb{R}$, and $y^i \in \mathbb{R}$. Let $w = (w(1), w(0)) \in \mathbb{R}^2$. Learn the optimal w_* for loss function $L(w) = \sum_i L_i(w)$, where $L_i(w) = (w(1)x^i + w(0) - y^i)^2$. [30 Marks]

Q3) Data in the file *logistic* is given in the form $(x^i, y^i)_{i=1}^n$, where $x^i \in \mathbb{R}^2$, and $y^i \in \{-1, +1\}$. Let $w = (w(2), w(1), w(0)) \in \mathbb{R}^3$. Let $\pi(y = +1, x, w) = \frac{1}{1+exp(-(w(2)x(2)+w(1)x(1)+w(0)))}$ and $\pi(y = -1, x, w) = \frac{1}{1+exp((w(2)x(2)+w(1)x(1)+w(0)))}$. Learn the optimal w_* for loss function $L(w) = \sum_i L_i(w)$, where $L_i(w) = -\log \pi(y^i, x^i, w)$. [20 Marks]