İZMİR KÂTİP ÇELEBİ UNIVERSITY

2010

INTRODUCTION TO MACHINE LEARNING

HOMEWORK 2

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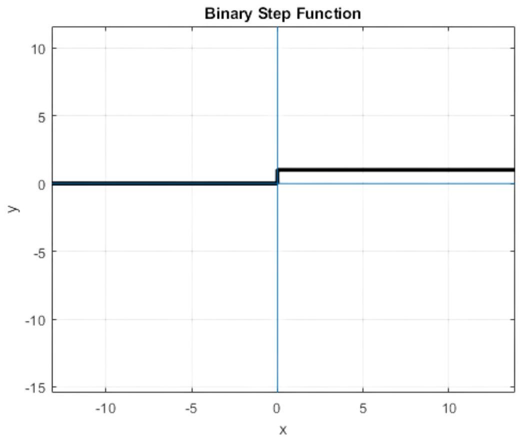
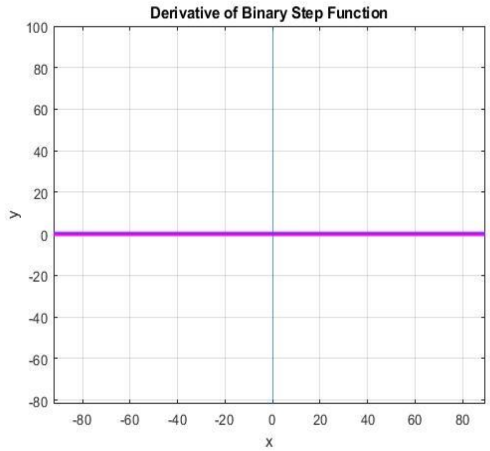
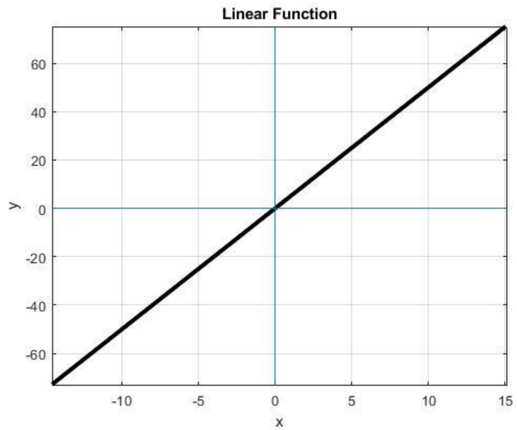
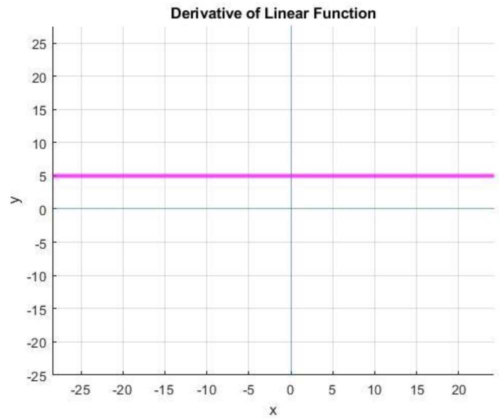
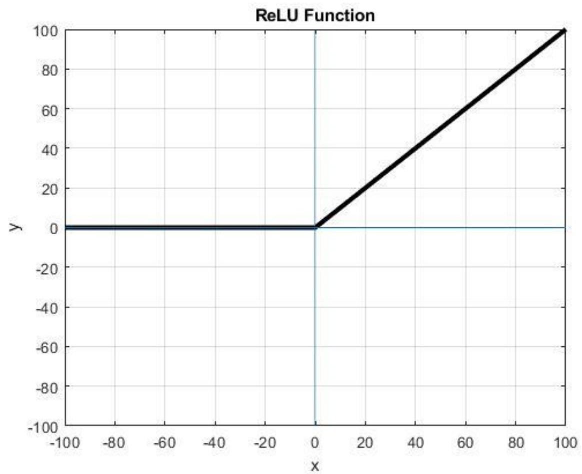
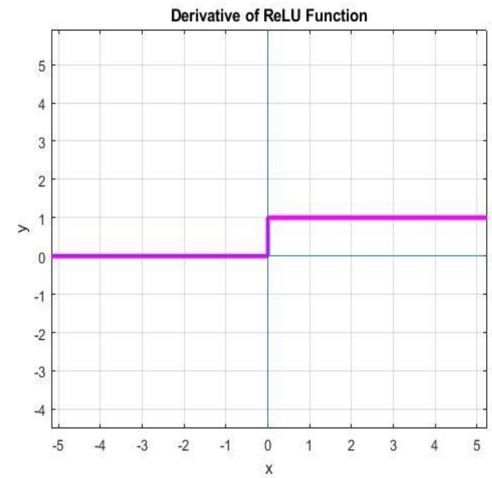
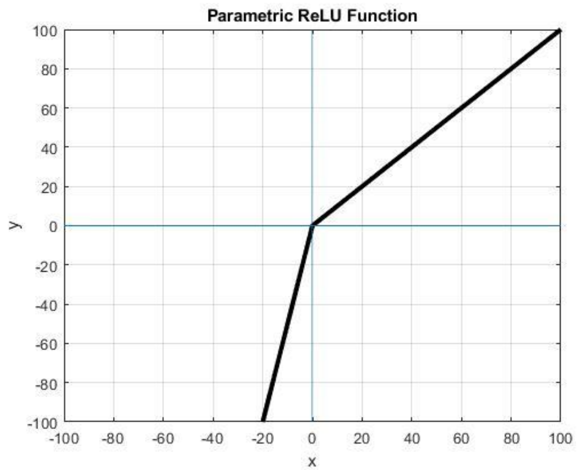
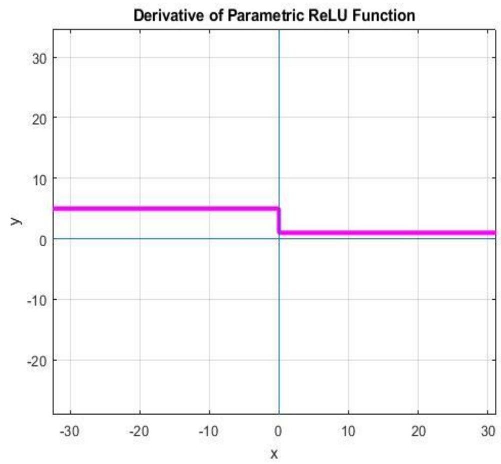
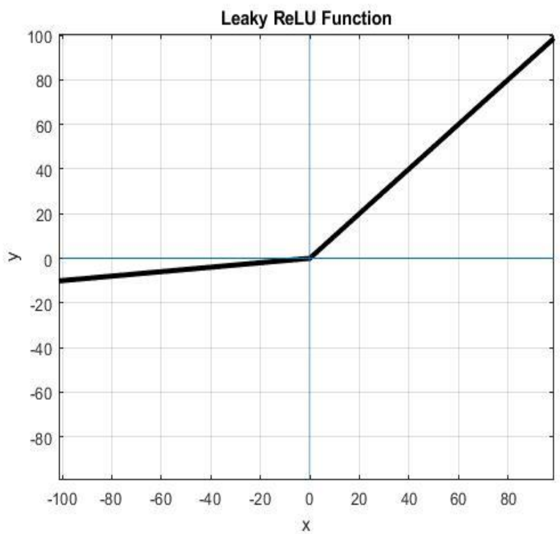
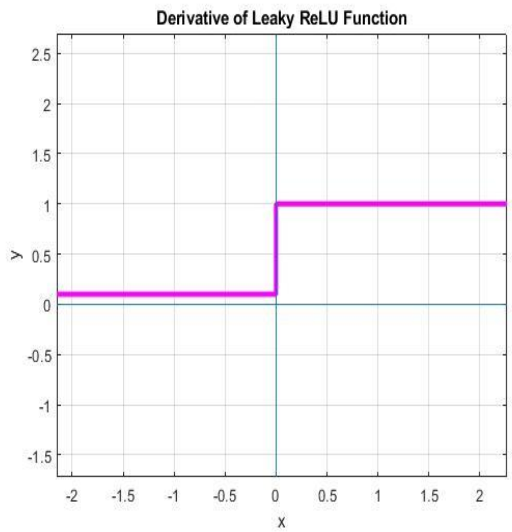
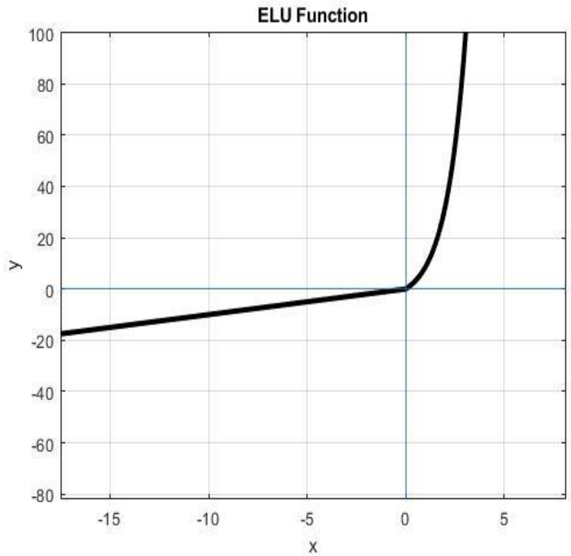
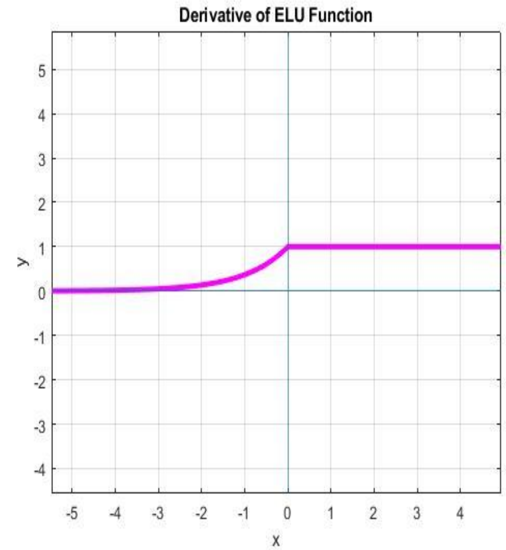
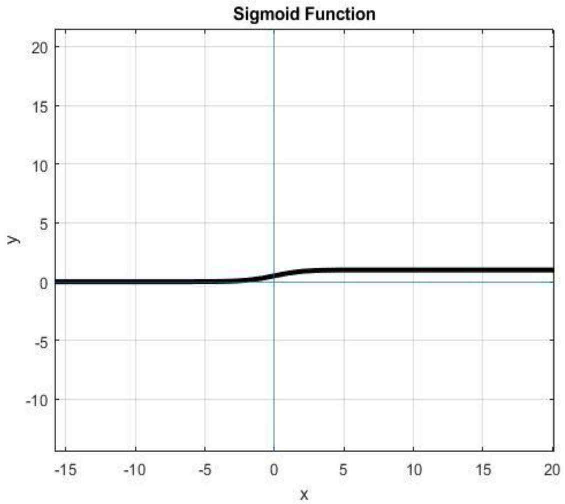
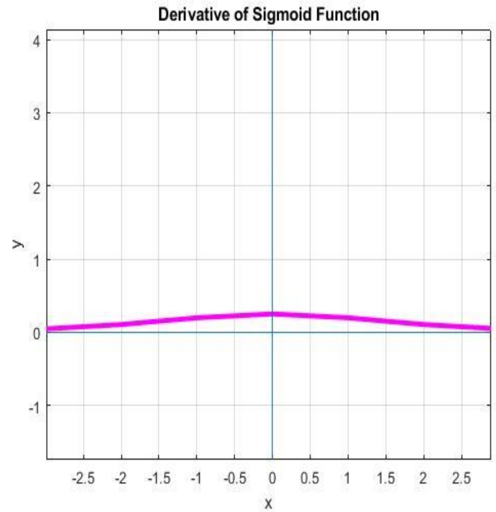
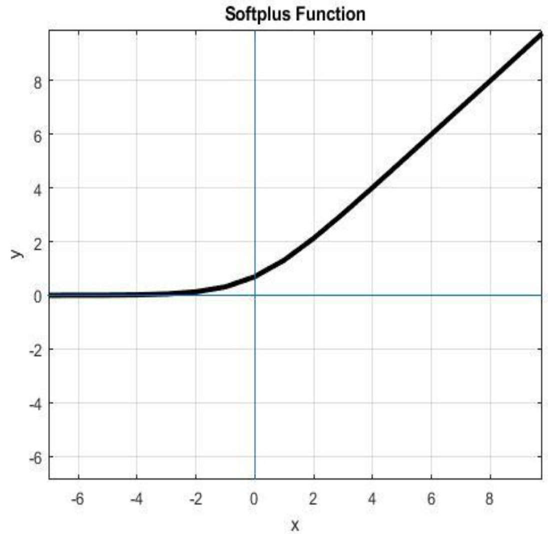
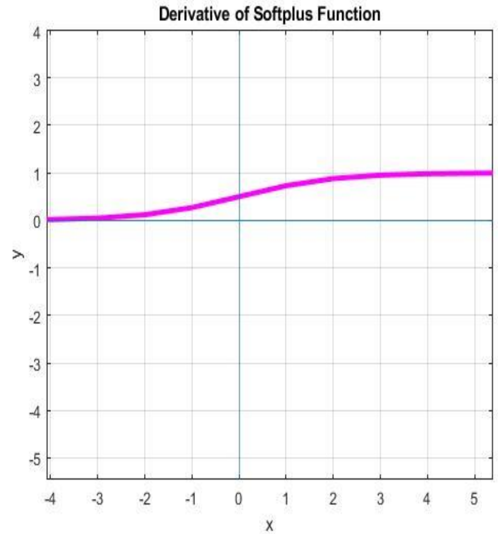
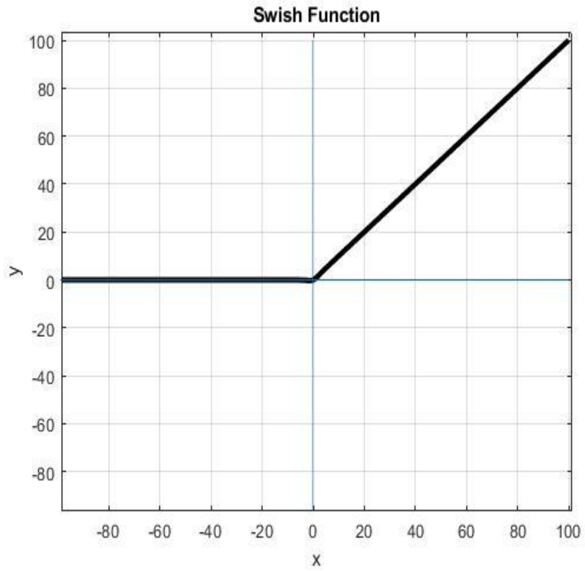
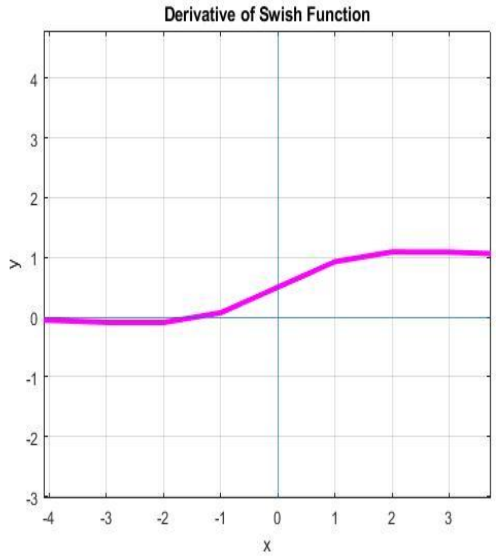
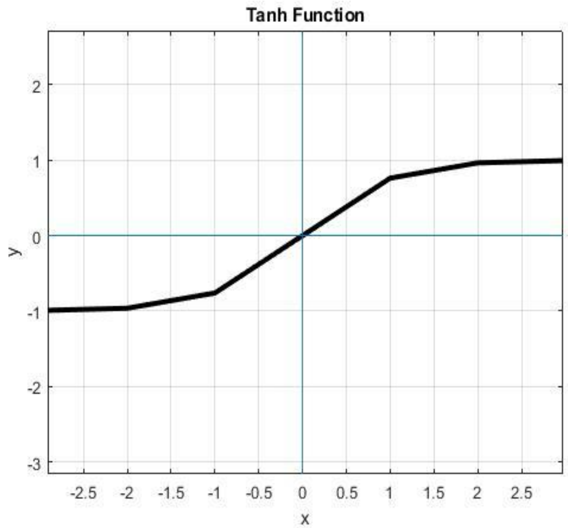
➢ I plotted 10 different activation functions and their derivatives using MATLAB.

Name of the Functions	f(x)	Figure of f(x)	f'(x)	Figure of f'(x)
Binary Step	f(x)= $\begin{cases} 0, & x < 0 \\ 1, & x \geq 0 \end{cases}$		f'(x)=0	
Linear	f(x)=ax (I used a as 5)		f'(x)=a	

ReLU	f(x)= $\begin{cases} 0, & x < 0 \\ x, & x \geq 0 \end{cases}$		f’(x)= $\begin{cases} 0, & x < 0 \\ 1, & x \geq 0 \end{cases}$	
Parametric ReLU	f(x)= $\begin{cases} ax, & x < 0 \\ x, & x \geq 0 \end{cases}$ (I used a as 5)		f’(x)= $\begin{cases} a, & x < 0 \\ 1, & x \geq 0 \end{cases}$	

Leaky ReLU	f(x)= $\begin{cases} 0.1x, & x < 0 \\ x, & x \geq 0 \end{cases}$		f’(x)= $\begin{cases} 0.1, & x < 0 \\ 1, & x \geq 0 \end{cases}$	
ELU	f(x)= $\begin{cases} x, & x < 0 \\ az, & x \geq 0 \end{cases}$ z=$(e^x - 1)$ (I used a as 5)		f’(x)= $\begin{cases} a + az, & x < 0 \\ 1, & x \geq 0 \end{cases}$ z=$(e^x - 1)$ (I used a as 1)	

Sigmoid	f(x)=$\frac{1}{(1+e^{-x})}$		f'(x)= $\frac{e^{-x}}{(1+e^{-x})^2}$	
Softplus	f(x)=$\log(1 + e^{x})$		f'(x)= $\frac{e^{x}}{(1+e^{x})}$	

Swish	f(x)=$\frac{x}{(1+e^{-x})}$		f'(x)= $\left(\frac{1}{(1+e^{-x})}+\frac{xe^{-x}}{(1+e^{-x})^2}\right)$	
Tanh	f(x)=$\frac{e^{x}-e^{-x}}{e^{x}+e^{-x}}$		f'(x)=1 $-\left(\frac{e^{x}-e^{-x}}{e^{x}+e^{-x}}\right)^2$