Machine Learning - Optimization

Min/Max Mean Temperature

Station	Year	Min	Max
Stockholm	1960	-2.36	1.69
Stockholm	1990	-1.57	1.99
Stockholm	2019	-1.75	2.27
Madrid	1960	-2.32	1.94
Madrid	1990	-1.74	2.17
Madrid	2019	-1.74	2.35
Kassel	1960	-3.45	1.69
Kassel	1990	-1.75	2.48
Munchen B	2019	-1.68	2.36

Observations about weather station temperatures over the span of 60 years:

- For all three stations, the mean temperatures have risen every 30 years. (Muenchen is replacing Kassel due to missing values in data, but for previous years, Muenchen always have had lower mean temperatures than Kassel.)
- Kassel either had an exceptionally cold day in 1960, or there is a mistake in measurements.
- The minimum mean temperature in these stations don't reach below -2.0 anymore in 1990 nor 2019.
- In 2019, Stockholm max temperatures are comparable to the much more southern station of Madrid.

Gradient Descent Optimization

Station	Year	Starting theta0, theta1	Ending theta0, theta1	Iteration	Step Size
Stockholm	1960	0, 0	-0.66, 0.31	250	0.1
Stockholm	1990	0, 0	0.032, 0.068	100	0.01
Stockholm	2019	0, 0	-0.23, 0.21	200	0.1
Madrid	1960	0, 0	-0.25, 0.07	250	0.1
Madrid	1990	0, 0	-0.13, 0.13	250	0.1
Madrid	2019	0, 0	-0.17, 0.18	250	0.1
Kassel	1960	0, 0	-0.23, 0.15	200	0.1
Kassel	1990	0, 0	0.019, 0.046	100	0.01
Munchen B	2019	0, 0	-0.09, 0.18	250	0.1

Loss Function and Loss Profile Plots

Stockholm 1960 Loss Function
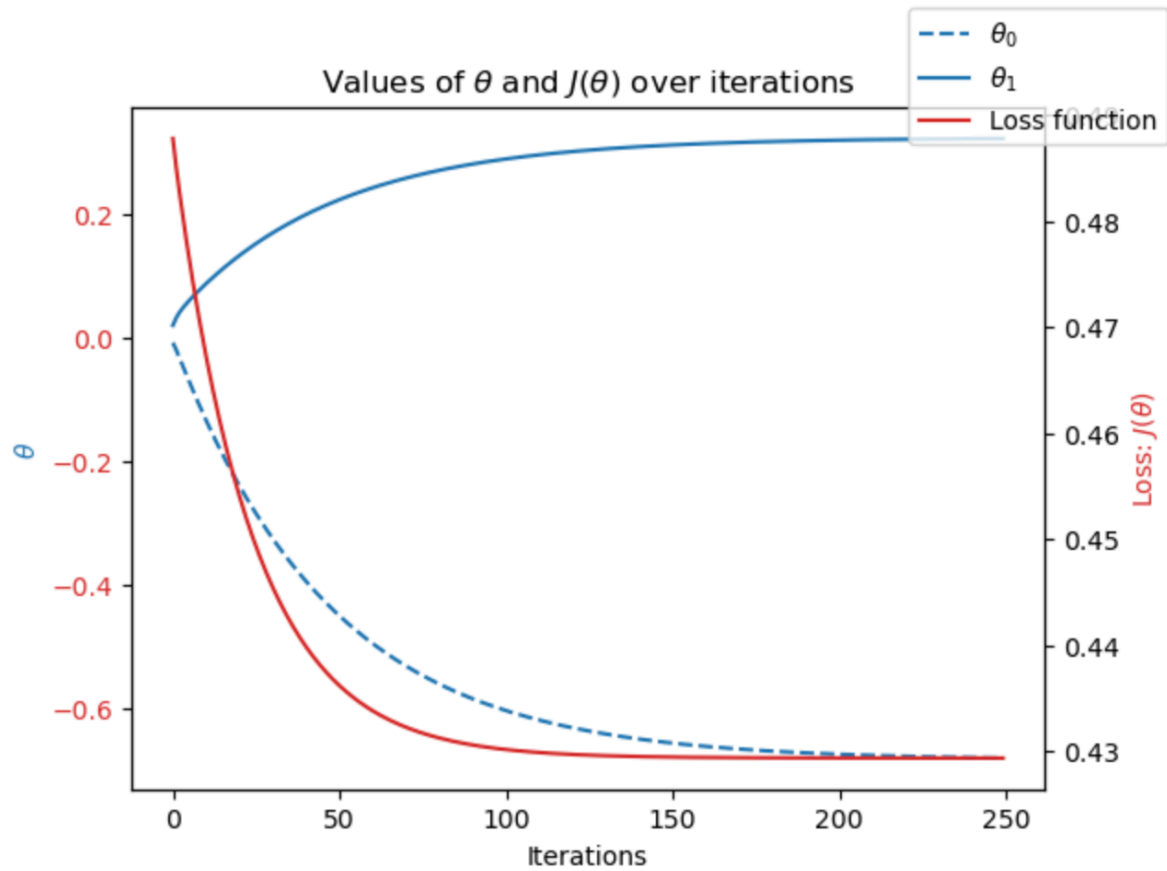
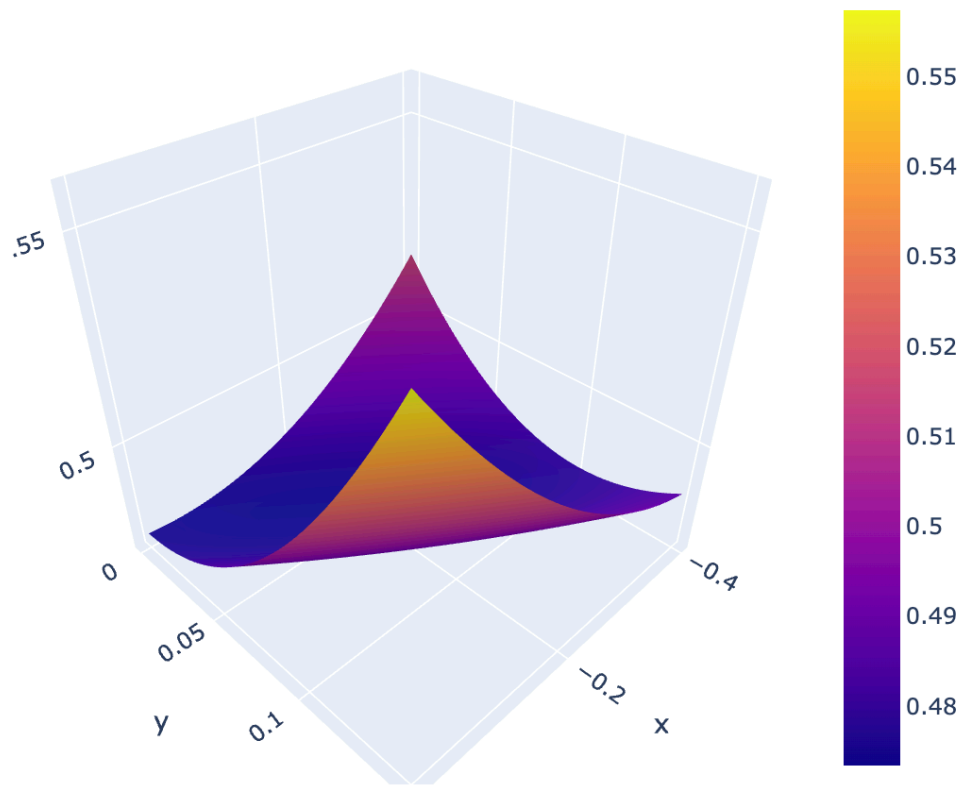# Stockholm 1960 Loss Profile

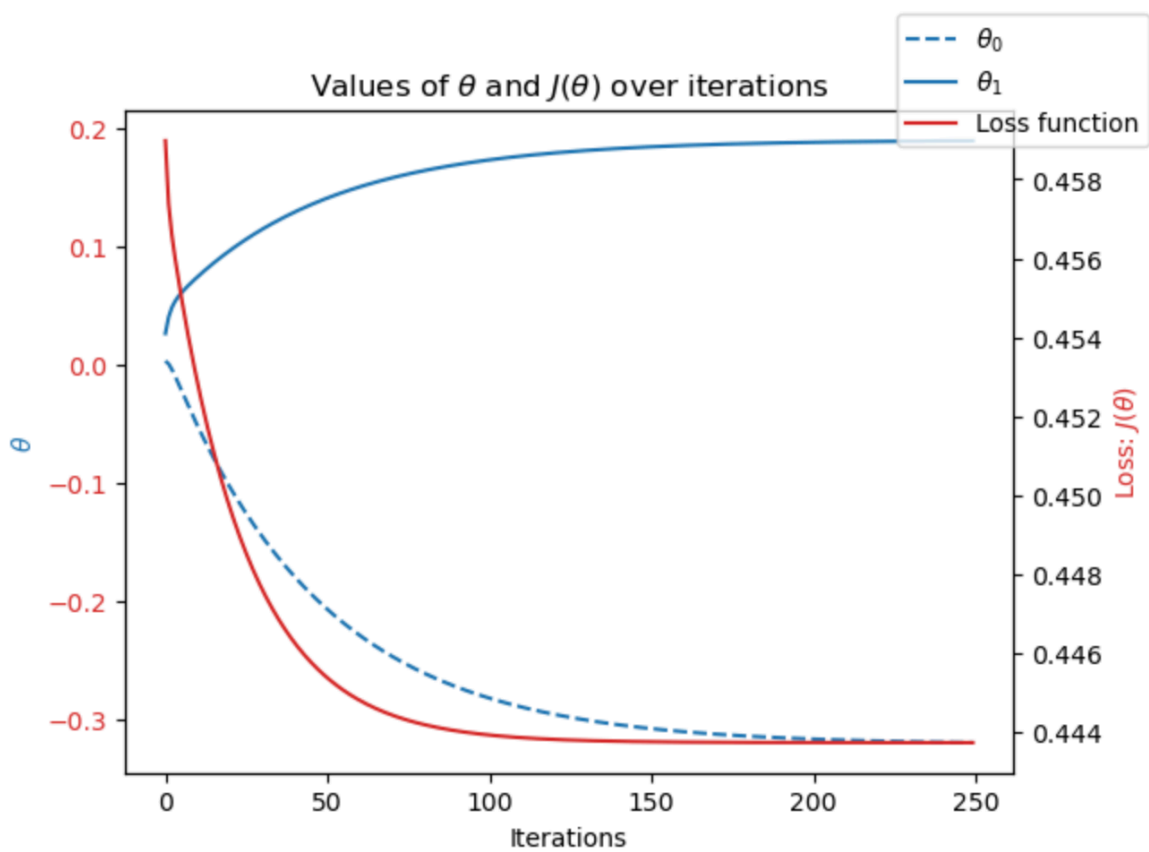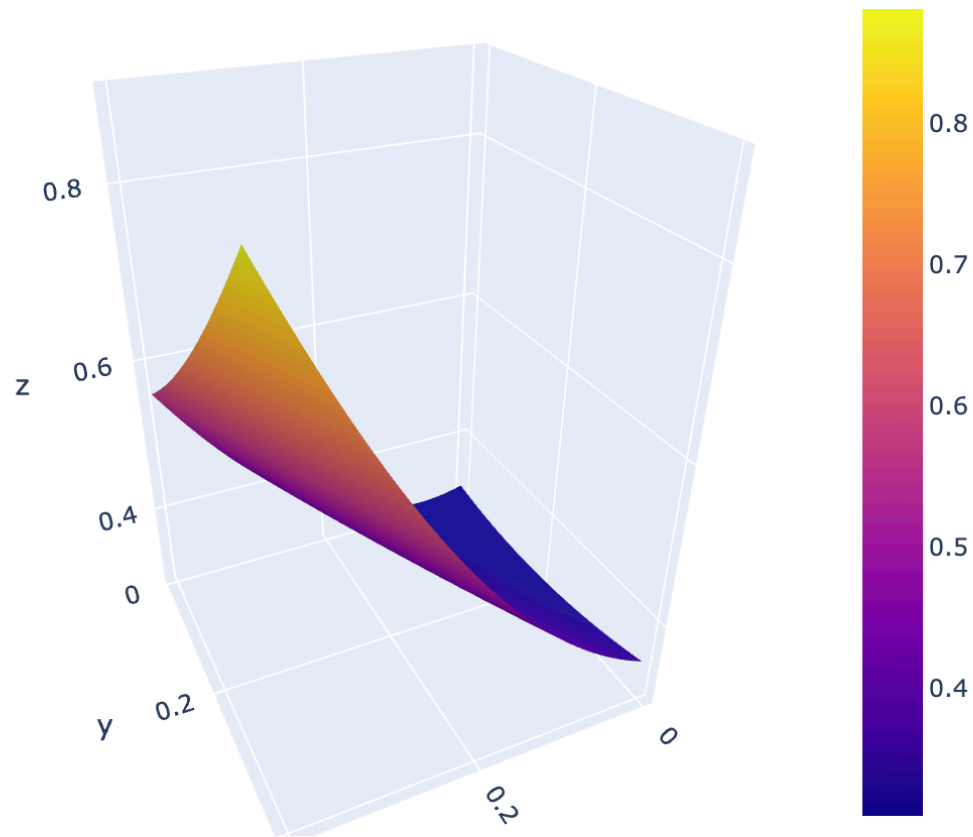## Loss function for different thetas
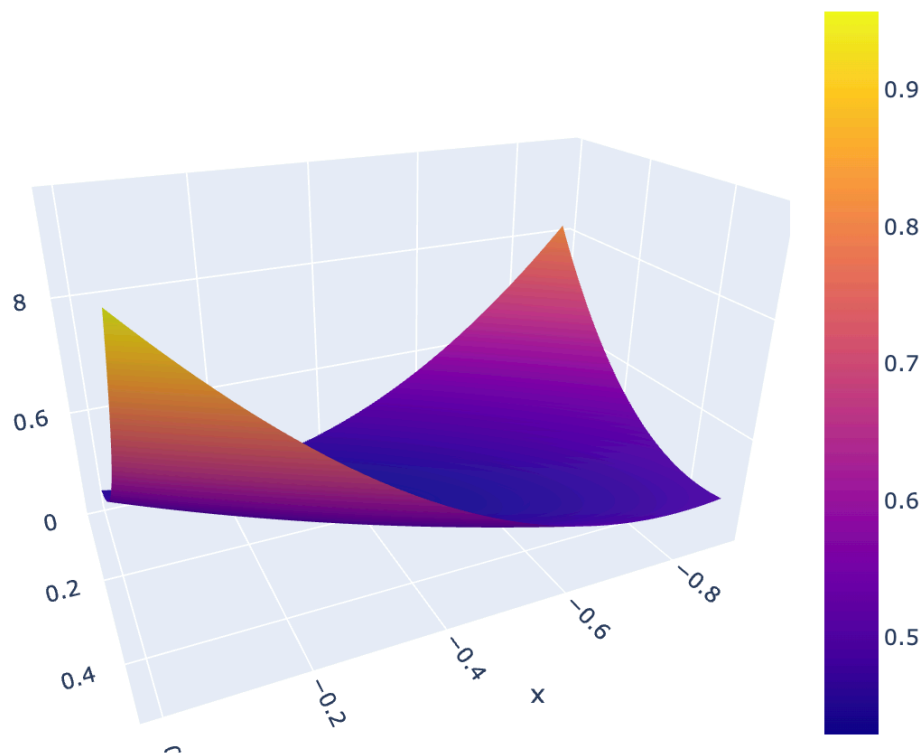
Madrid 1960 Loss Function

Values of θ and $J(\theta)$ over iterations
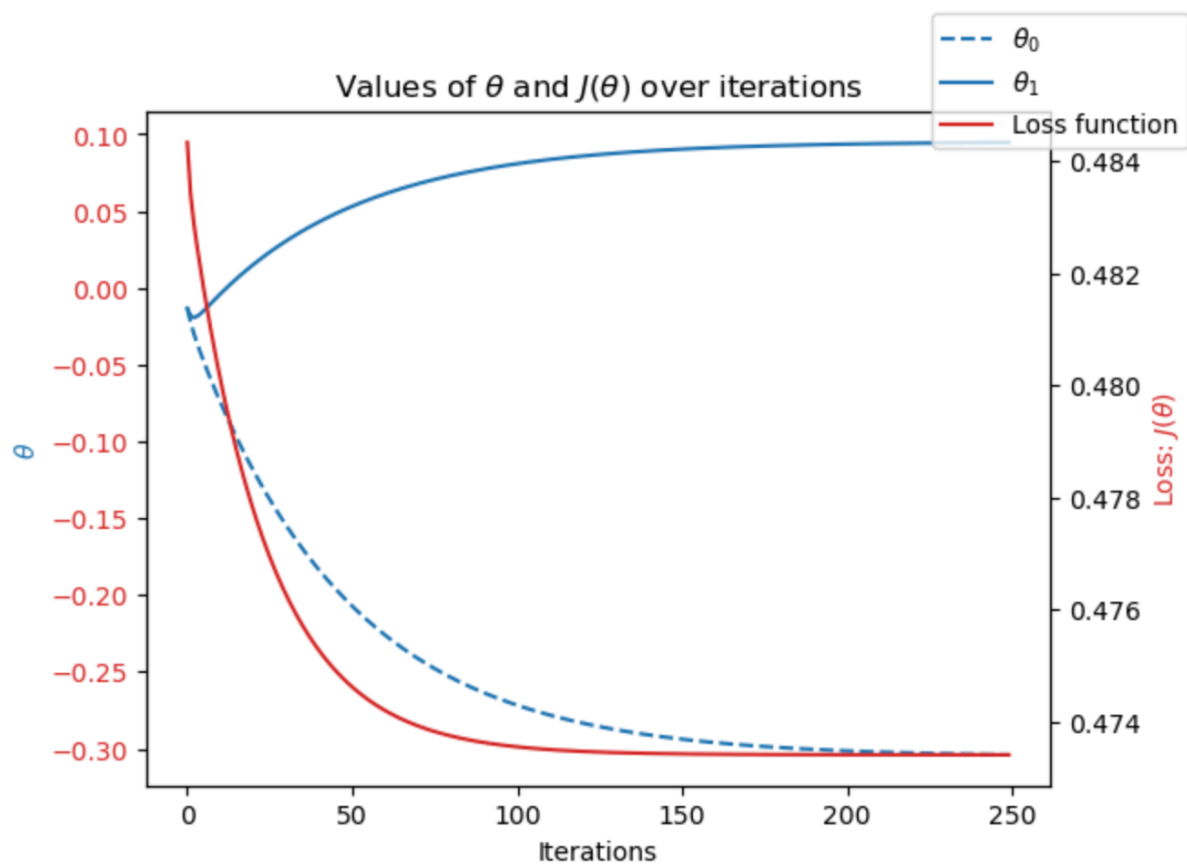
Madrid 1960 Loss Profile

Loss function for different thetas

Kassel 1960 Loss Function

Values of θ and $J(\theta)$ over iterations

Kassel 1960 Loss Profile

Loss function for different thetas
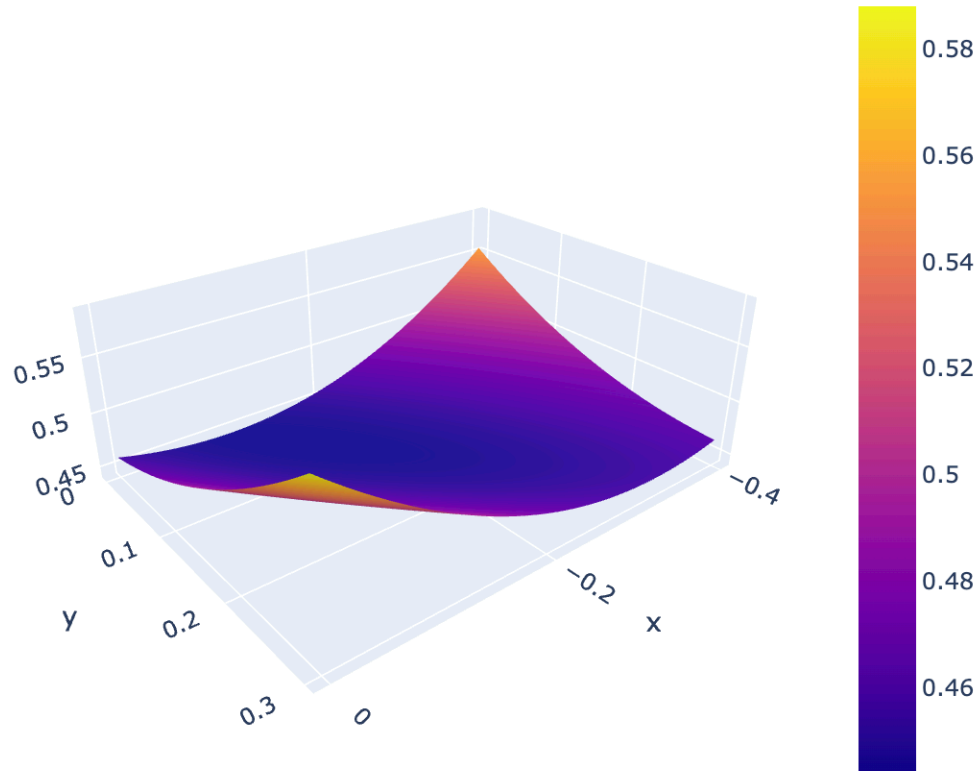
Stockholm 1990 Loss Function
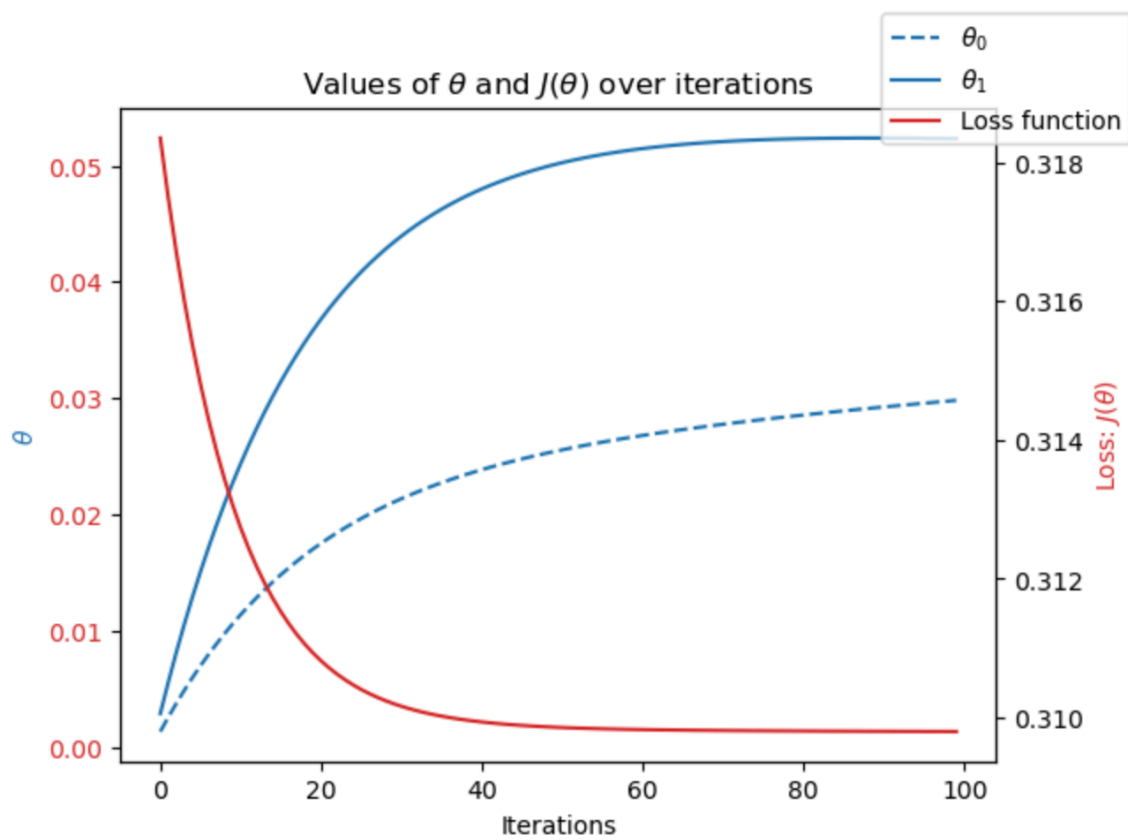
Stockholm 1990 Loss Profile
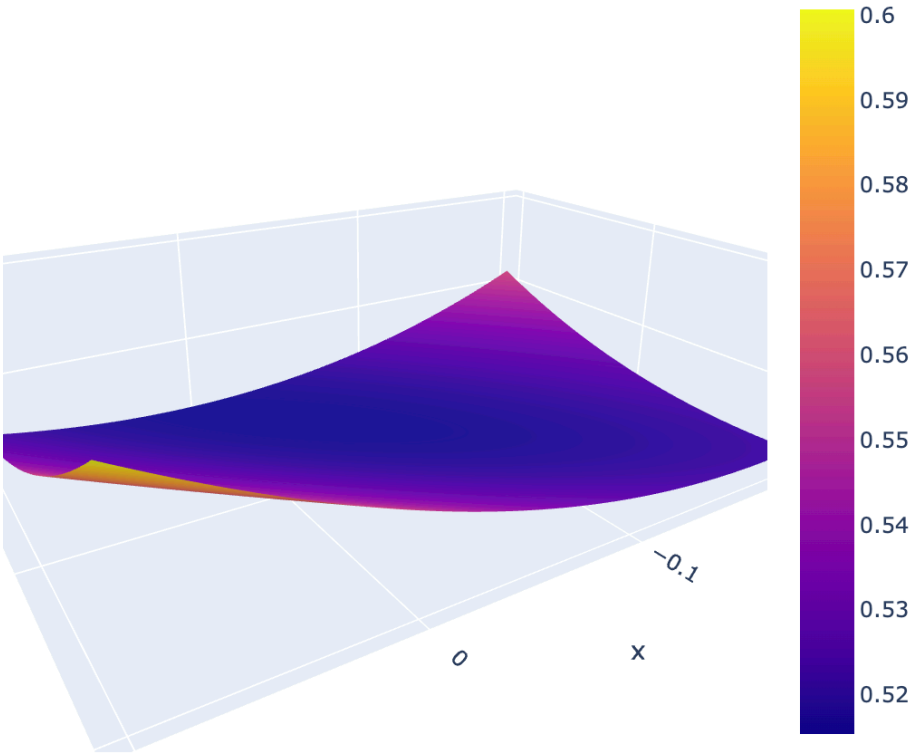
Loss function for different thetas

Madrid 1990 Loss Function

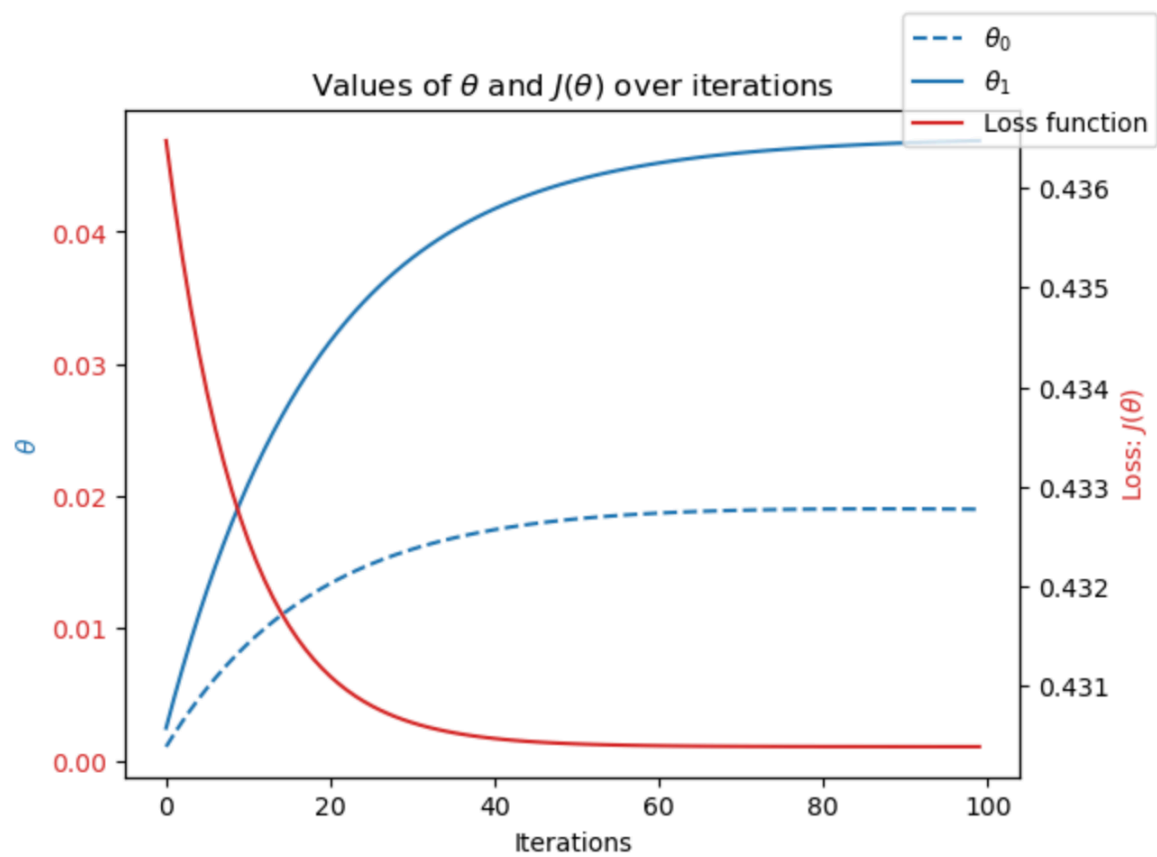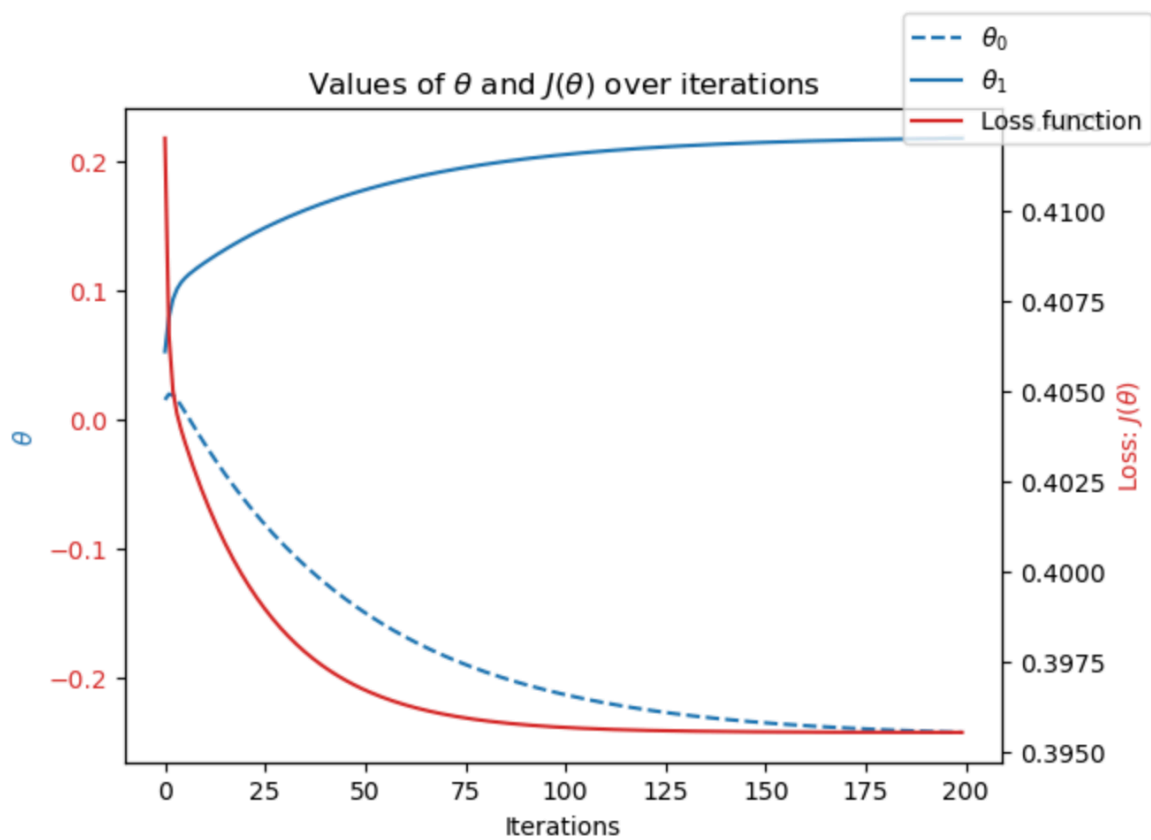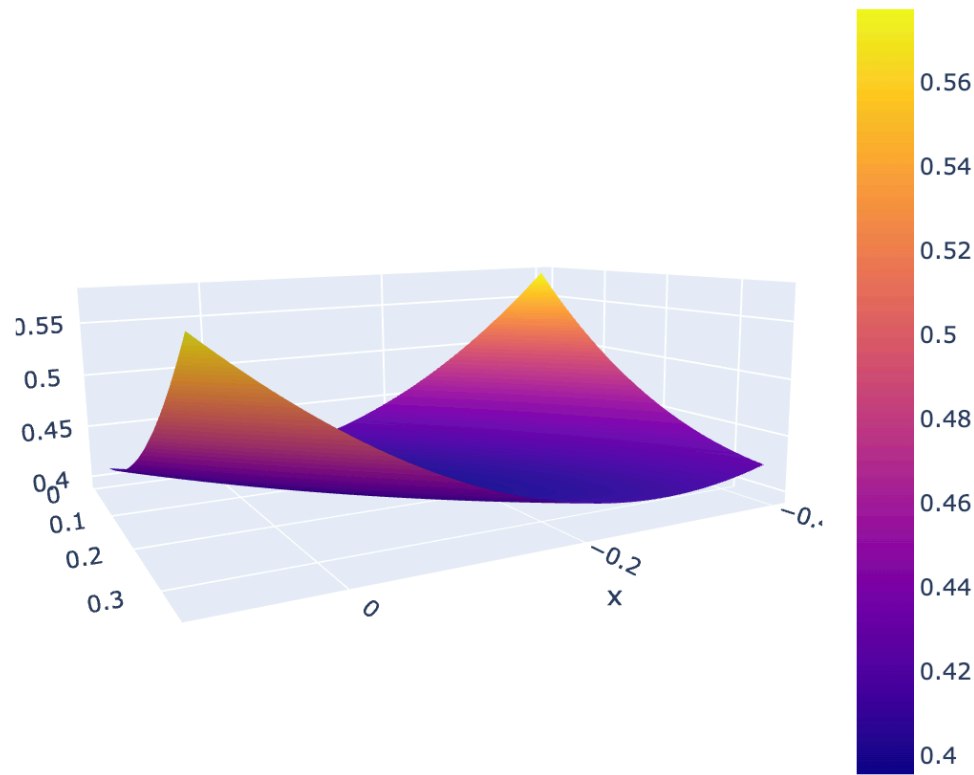Values of θ and $J(\theta)$ over iterations
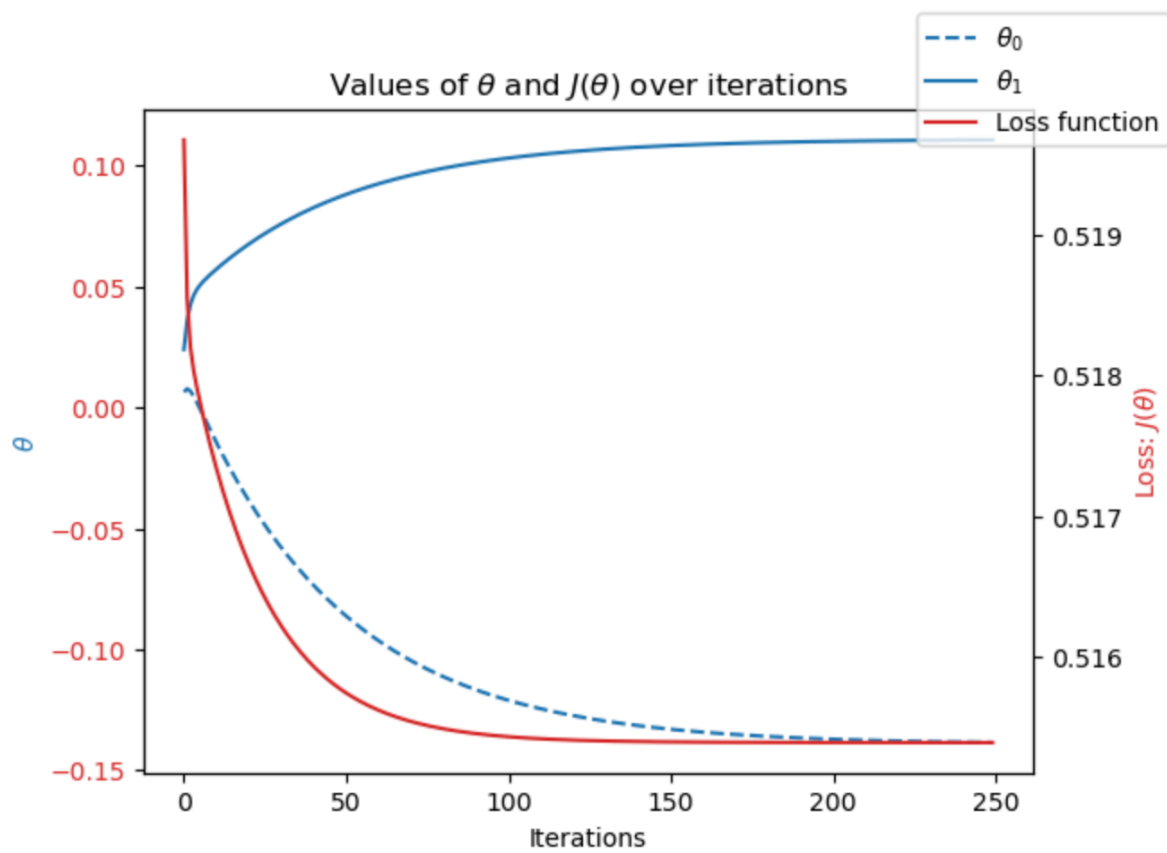
Madrid 1990 Loss Profile

Loss function for different thetas

Kassel 1990 Loss Function

Values of θ and $J(\theta)$ over iterations

Kassel 1990 Loss Profile

Loss function for different thetas
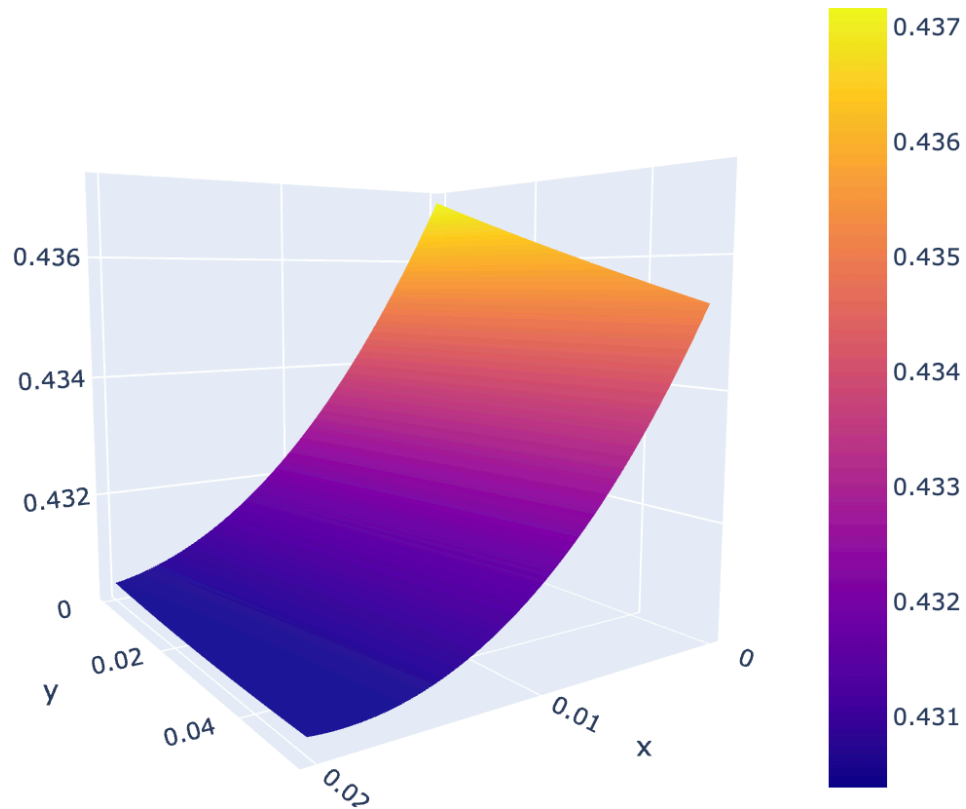
Stockholm 2019 Loss Function

Values of θ and $J(\theta)$ over iterations

Stockholm 2019 Loss Profile

Loss function for different thetas

Madrid 2019 Loss Function

Values of θ and $J(\theta)$ over iterations
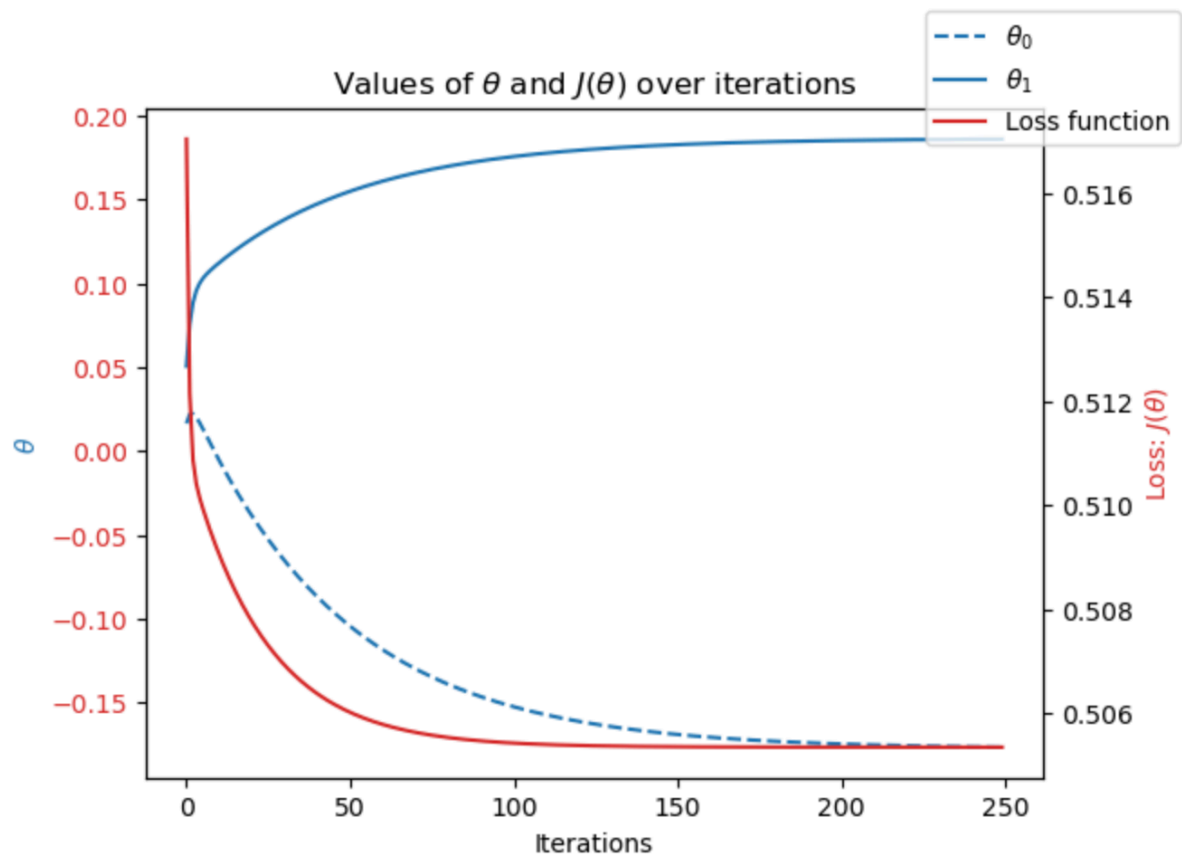
Madrid 2019 Loss Profile

Loss function for different thetas
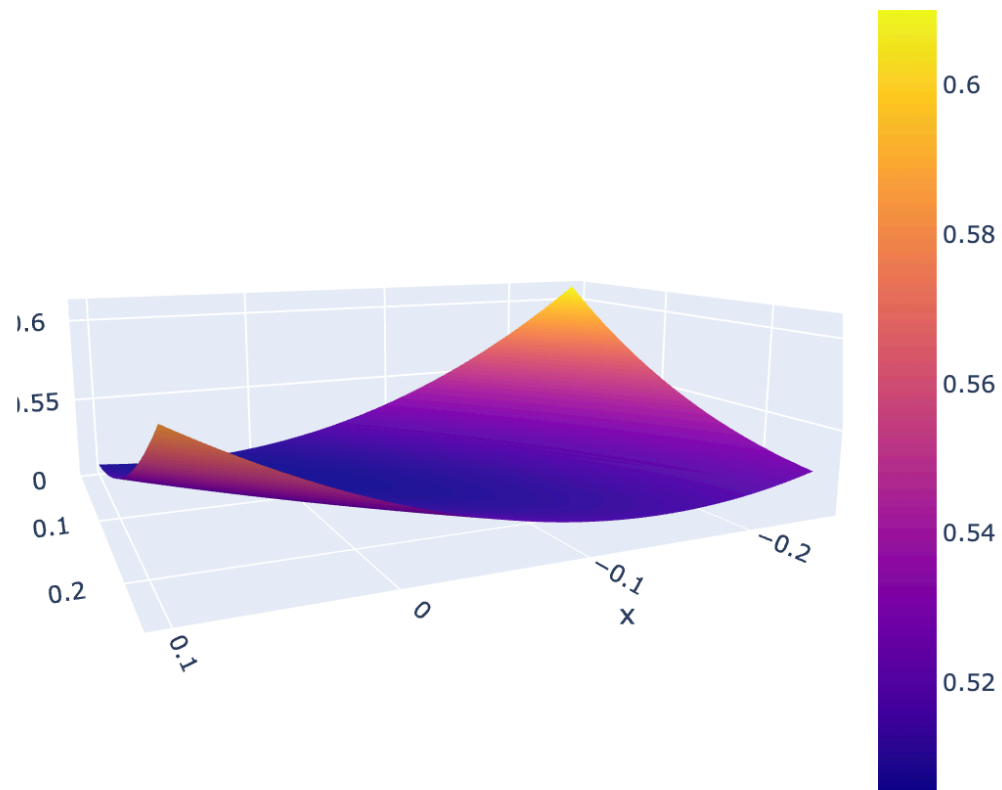
Munchen B 2019 Loss Function

Values of θ and $J(\theta)$ over iterations
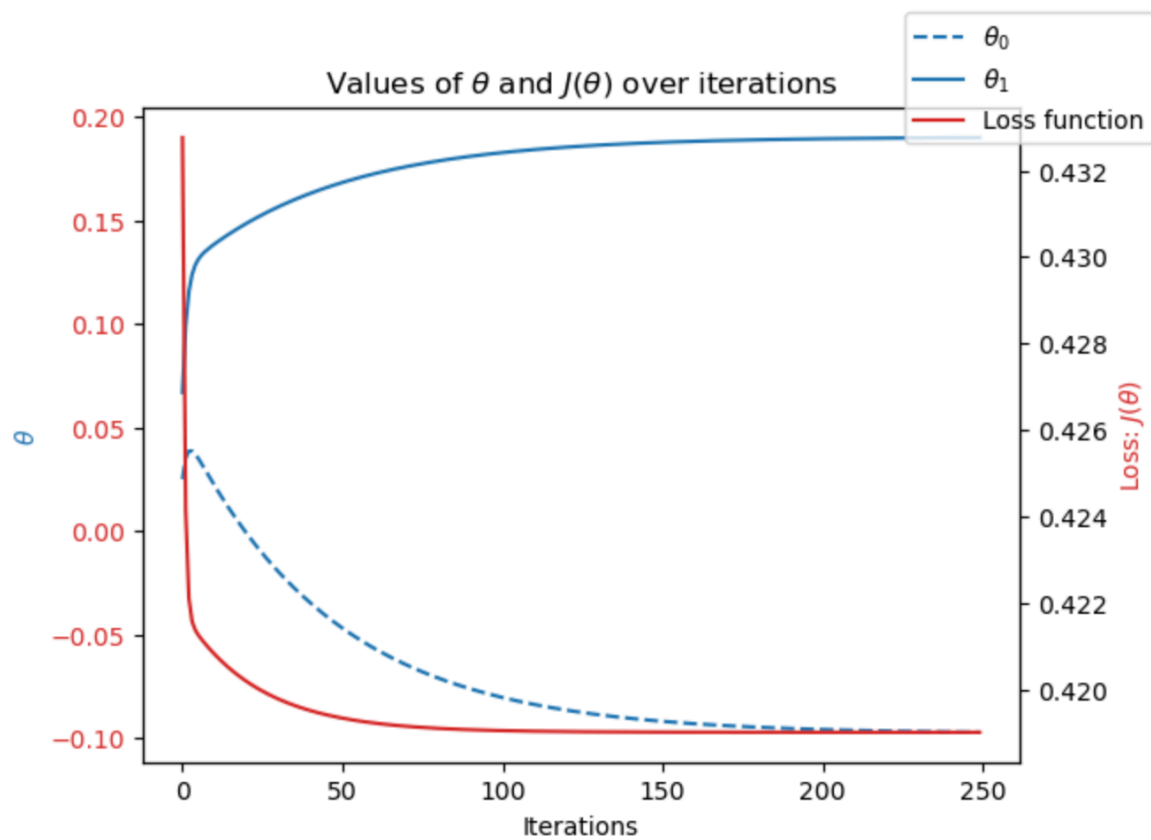
Munchen B 2019 Loss Profile

Loss function for different thetas