

ILM2

GRADIENT BASED LEARNING PROBLEM SET

We know how to fit lines or linear functions. What about when the function is non-linear?

Consider the corona data of your choice (eg. countries / states / cities / world) and what (infected, tested, death, recovered). You can also take multiple such data.

- ① fit a function-model that suits the data. clearly explain why this is good model, including references.

write the objective function and how to optimize with GD and newton's. your output is a brief report (not more than one page in writing).

$$f_0(x) = \tanh x$$

$$f(x) = a \tanh x$$

26.4.2020

DATASET

humdata.org \longrightarrow confirmed cases global (cumulative)

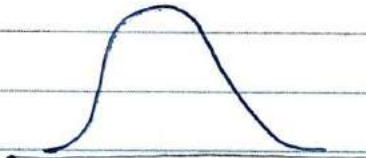
MODIFYING DATASET

total cases \longrightarrow daily new cases \longrightarrow 2 week avg. new cases
(trends visible) (easy to work with)

OBJECTIVE FUNCTION

$$f(x) = a e^{-\frac{(x-b)^2}{2c^2}} + b e^{-\frac{(x-m)^2}{2n^2}}$$

2 bell-shaped curves (gaussian fn.)



why?

daily new cases should reach a maximum and decrease to 0, considering precautions as 2 effects, we have 2 gaussian fns.

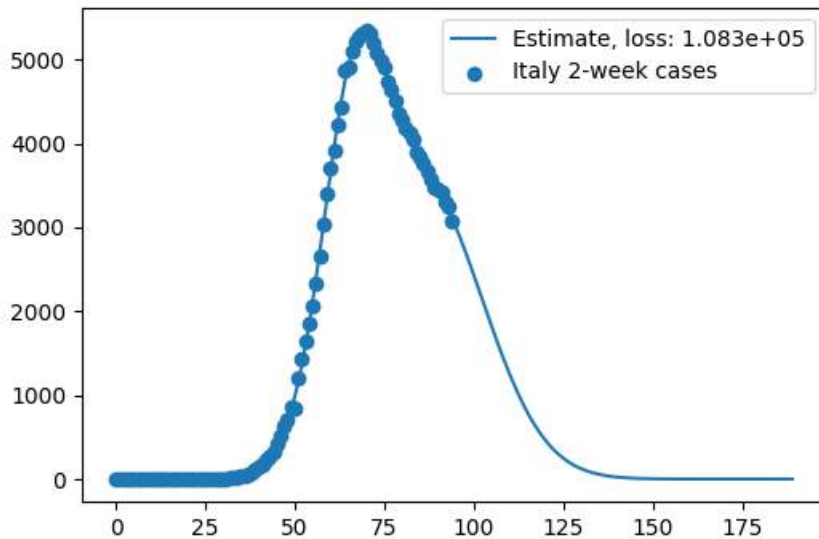
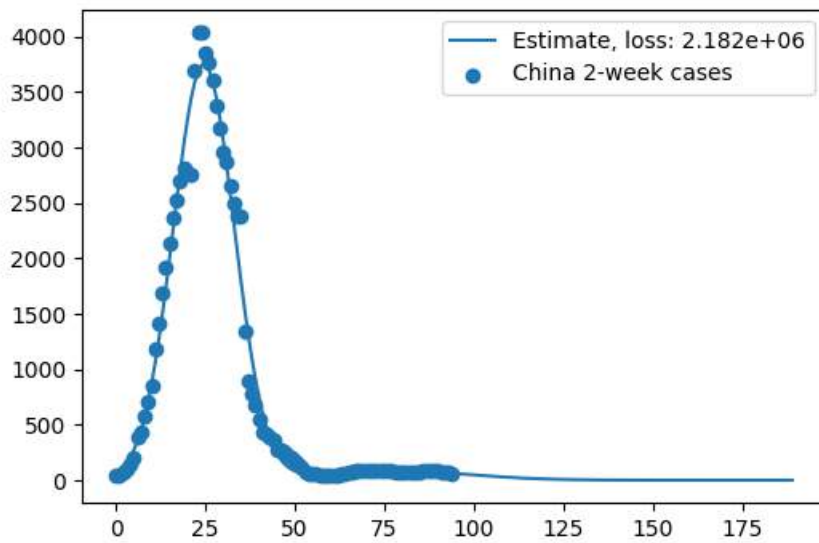
OPTIMIZATION

$$\text{loss}(x, y) = \sum_{x \in X} (y_x - f(x))^2$$

: objective for GD, newton's.

$$\text{GD: } x_1 = x_0 - \eta \times \nabla \text{loss}(x, y)$$

$$\text{newton's: } x_1 = x_0 - H^{-1}(\text{loss}(x, y)) \nabla \text{loss}(x, y)$$



```
wolfram77@hp:~/Documents/om-ilm2$ ./main.py
Current total cases: 83642
Initial total cases: 50132

Current total cases: 83642
Estimate total cases: 84583

low cases 9 on 2020-05-23 00:00:00
wolfram77@hp:~/Documents/om-ilm2$ █
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CHINA

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wolfram77@hp:~/Documents/om-ilm2$ ./main.py
Current total cases: 176473
Initial total cases: 50132

Current total cases: 176473
Estimate total cases: 221732

low cases 9 on 2020-06-15 00:00:00
wolfram77@hp:~/Documents/om-ilm2$ █
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ITALY