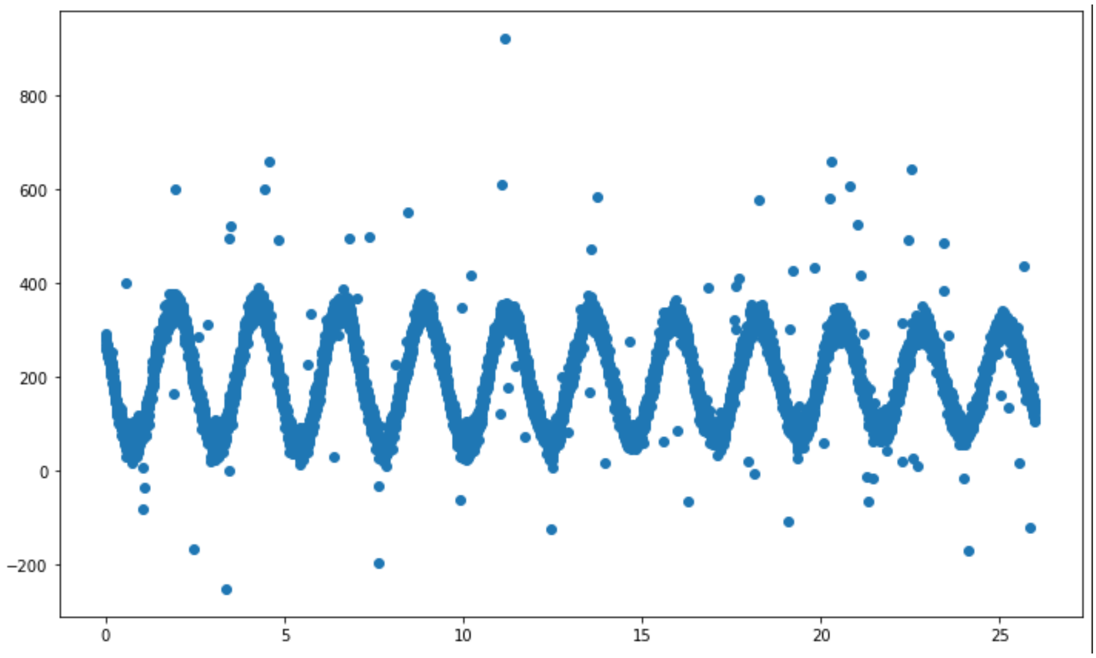
HA 1

prepared by Danila Danko

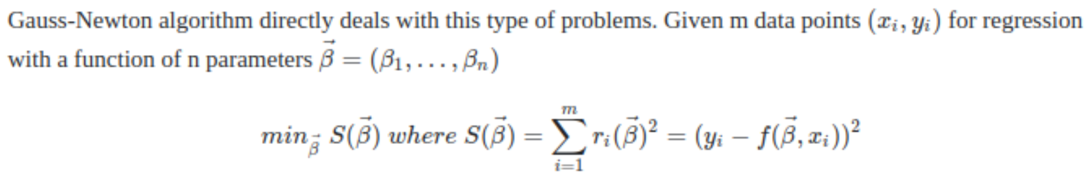
Task 1

In Task 1, I took the dataset for my case (case 1) and visualized it.



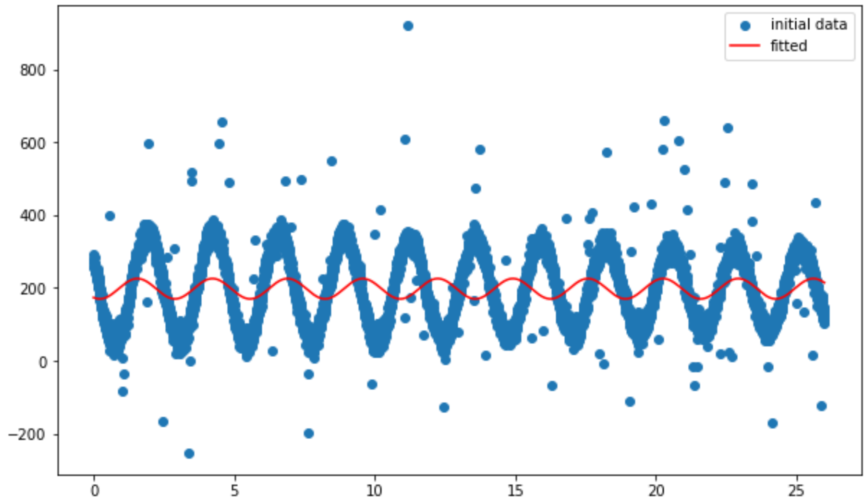
I noticed that the points resemble a sin wave. That's why, I decided not to use Linear Regression.
Instead, I learned about Gauss-Newton's method here (link) and implemented it for my problem.

I switched to the following formulation of my problem:


Gauss-Newton algorithm directly deals with this type of problems. Given m data points (x_i, y_i) for regression with a function of n parameters $\vec{\beta} = (\beta_1, \ldots, \beta_n)$

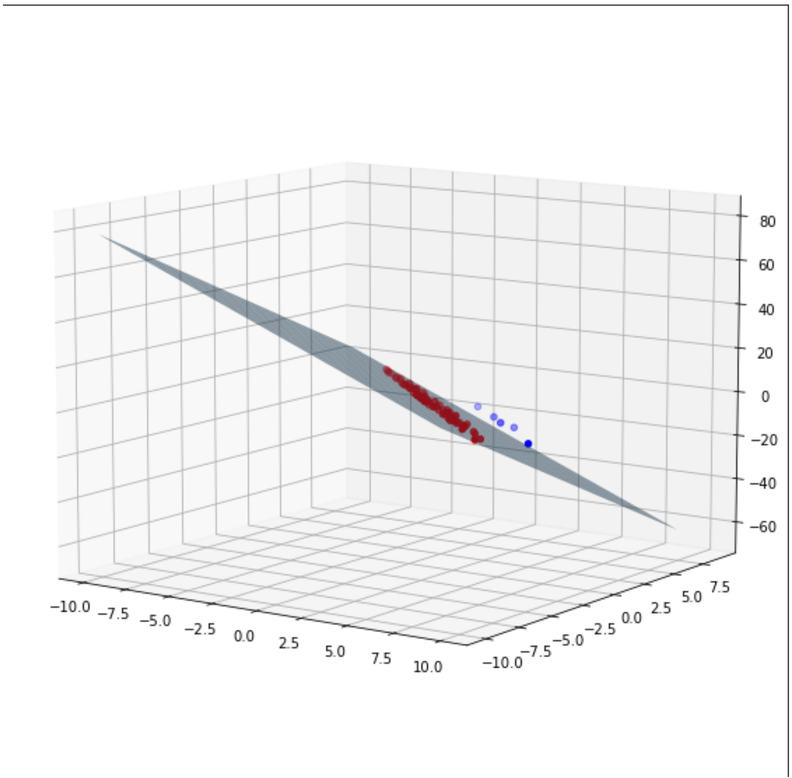
$$min_{\vec{\beta}}\ S(\vec{\beta})\ where\ S(\vec{\beta}) = \sum_{i=1}^{m} r_i(\vec{\beta})^2 = (y_i - f(\vec{\beta}, x_i))^2$$

And implemented the suggested algorithm. I tried it with different initial values and damping factor, and it was unable to find the correct amplitude. Unsurprisingly, because the algorithm may not converge. Here is the final result.



Task 2

In task 2, I used **dataset 8** and `sklearn.linear_model.RANSACRegressor` to fit the data provided there. To make an experiment, I nade some points the outliers (blue). The inliers are red.



For `residual_threshold`, I applied [median absolute deviation] since it's a "robust estimator of dispersion".
I set `min_samples` = 3, since it's the minimal number of points required to construct a plane from a non-degenerate triangle. That the data represents a plane is obvious from the scatter plots.
Finally, I observed that 100 iterations are enough to exclude all my outliers.