

Assignment for Research and Development/AI

1) L1 Distance (uniformly sampled $t \in [6, 60]$)

- Total L1 = 37865.095535
- Average L1 per point = 25.243397

2) Explanation of Process

Goal: Estimate unknowns θ , M , X

$$x(t) = t \cos \theta - e M t \sin(0.3t) \sin \theta + X$$

$$y(t) = 42 + t \sin \theta + e M |t| \sin(0.3t) \cos \theta.$$

Data: The CSV contains only (x, y) points. Following the prompt (“uniformly sampled points”), we reconstruct t via:

$$t_i = 6 + i \cdot \frac{60-6}{N-1}, \quad i=0, \dots, N-1.$$

Metric: Minimize **L1 distance**

$$L1 = \sum_i (|x_i - x(t_i)| + |y_i - y(t_i)|).$$

Method:

1. Load CSV, set uniform $t \in [6, 60]$.
2. Define model $x(t)$, $y(t)$ as above.
3. Use bounded optimization (respecting ranges: $\theta \in (0, 50^\circ)$, $M \in (-0.05, 0.05)$, $X \in (0, 100)$) to minimize L1.
4. Converged parameters:
 - $\theta = 0.490777338 \text{ rad} \approx 28.13^\circ$
 - $M = 0.0213825022$
 - $X = 54.8999932$

Resulting curve (LaTeX)

$$\left(t \cos(0.490777338) - e^{\{0.0213825022 \sqrt{t} \}} \sin(0.3t) \sin(0.490777338) + 54.89999932, \right. \\ \left. 42 + t \sin(0.490777338) + e^{\{0.0213825022 \sqrt{t} \}} \sin(0.3t) \cos(0.490777338) \right)$$