

Why Optimization for ML?

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- Optimization is everywhere!
- Most Machine Learning techniques can be seen as optimization problems

Examples :-

Linear Regression

$$\min_{x \in \mathbb{R}^d} \|Ax - b\|_2^2$$

Support Vector Machines (SVM)

$$\min_{\substack{w \in \mathbb{R}^d \\ w_0 \in \mathbb{R}}} \|w\|_2^2$$

$$\text{s.t. } (w^T x_i + w_0) y_i \geq 1 \quad \forall i$$

k-Means Clustering

$$\min_{C = \{c_1, c_2, \dots, c_k\}} \sum_{i=1}^k \sum_{p \in U_i} \|p - c_i\|_2^2$$

What is common?

ML Training \approx Optimization
Some objective for given data

Lots of Avenues for Optimization in ML/DS

- Modeling / Formulation
- Computational Aspect
- Combinatorial Optimization and