■ Day 1 – Data Science Math Gym

Convexity & Loss Functions + Bayes’ Theorem & Probabilistic Inference

■ Concept 1: Convexity & Loss Functions

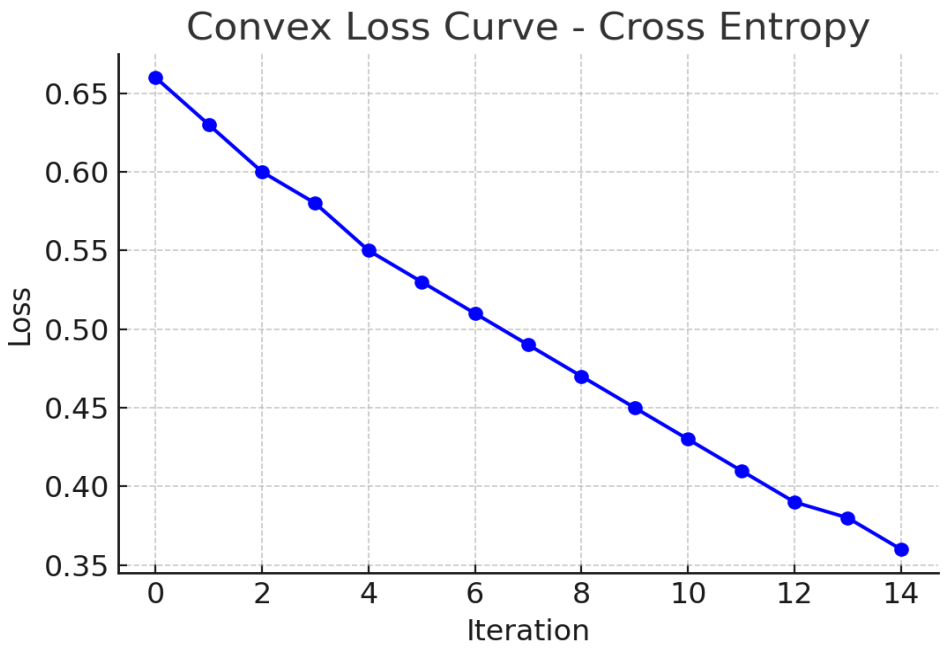
Imagine you're on a hill. If the ground curves up like a bowl, you can slide down to the bottom — the lowest point. That's convexity. In machine learning, we often use convex loss functions (like cross-entropy) because they guarantee our model won’t get stuck on a random hill. We'll always find the best answer — the global minimum. Logistic regression uses a sigmoid function to predict probabilities, and we train it by minimizing the convex loss. This makes the model learn smoothly and predict confidently.

■ Concept 2: Bayes’ Theorem & Probabilistic Inference

Bayes' Theorem helps us update our beliefs based on new evidence. It's like detective reasoning: if someone looks suspicious and their fingerprints match, the chance they’re guilty goes way up. In machine learning, Naive Bayes classifiers use this principle. We ask: “Given these features, what’s the probability the data point belongs to class A or B?” It gives us posterior probabilities — the model’s confidence in its prediction.

■ Visual Examples

■ Cross-Entropy Loss During Logistic Regression Training



■ Posterior Probabilities from Naive Bayes Classifier