Mathematics for Machine Learning Notes

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Contents

Chapter 1

Convex Analysis

A convex function is one that satisfies a specific property related to its shape.

1.1 Definition of a Convex Function

A function $f(x)$ is convex if, for any two points x_1 and x_2 in its domain, and any $\alpha \in [0, 1]$:

$$f(\alpha x_1 + (1 - \alpha)x_2) \leq \alpha f(x_1) + (1 - \alpha)f(x_2) \tag{1.1}$$

This means the function value at any weighted average of two points is less than or equal to the weighted average of the function values at those two points.

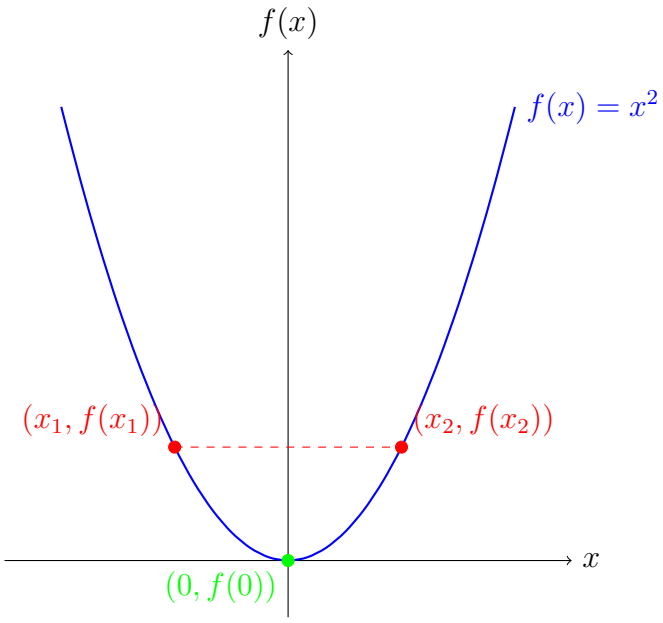

Figure 1.1: An example TikZ picture.

Chapter 2

Probability

2.1 Sample Space and Probability

2.1.1 Sets

$$S_1 = \{x_1, x_2, \ldots, x_n\}$$
$$S_2 = \{x_1, x_2, \ldots\}$$
$$S_3 = \{x \mid x \text{ satisfies } P\}$$
$$S_4 = \{x \mid 3 \leq x \leq 5, x \in \mathbb{R}\}$$

- $x_2 \in S_1$.
- S_2 is an countably infinite set, as elements are enumerable.
- S_4 is

Now let's consider following sets:

$$S_1 = \{x_1, x_2, \ldots, x_n\}$$
$$S_2 = \{x_1, x_2\}$$
$$S_3 = \{x_2, x_1\}$$

- $S_2 \subset S_1$.
- $S_2 = S_3$
- Ω: A universal set.

2.1.2 Set Operations

- Complement: $S^c = \{x \in \Omega \mid x \notin S\}$
- $\Omega^c = \varnothing$ (empy set)

Bibliography

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[3] G. Strang. *Introduction to Linear Algebra*. Wellesley, 2016.