Statistical Machine Learning

Review of Mathematical Foundations – Part 1

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Objectives

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Review basic notations from Calculus & Set Theory

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Review key Linear Algebra concepts and operations

Basic Notations from Calculus (1/3)

- Derivative of $f(x)$ with respect to x

- Partial derivative of a function $f(x,y,\ldots)$ with respect to x
  - Note: the function may be scalar-valued or vector-valued

Basic Notations from Calculus (2/3)

- $\Re^d$: d-dimensional Euclidean space.

- Gradient operator in $\Re^d$: ∇

Basic Notations from Calculus (3/3)

- The integral of $f(x)$ between a and b

- The argmin or argmax notation

Basic Notations from Set Theory (1/2)

- A set *S* is a collection of objects.
  - $\emptyset$: the empty set (a special set that contains no object)

- Some basic relations and operations

$x \in A$: An object *x* is a member of a set *A*.

$A \subseteq B$: Set *A* is a *subset* of *B* $\Leftrightarrow x \in A \Rightarrow x \in B$

$B \subset C$: Set *B* is a *proper subset* of *C*.

Basic Notations from Set Theory (2/2)

Some basic relations and operations

$A \cup B$: The union of *A* and *B.*

$A \cap B$: The intersection of *A* and *B.* (*AB* in shorthand)

A^c or $\overline{A}$: The complement of *A*

A and *B* are disjoint if $A \cap B = \emptyset$