

Notation

Numbers and Arrays

| Syntax | Description |
|-------------------------------|--|
| a | A scalar (integer or real) |
| \mathbf{a} | A vector |
| \mathbf{A} | A matrix |
| \mathbf{A} | A tensor |
| \mathbf{I}_n | Identity matrix with n rows and n columns |
| \mathbf{I} | Identity matrix with dimensionality implied by context |
| $\mathbf{e}^{(i)}$ | Standard basis vector $[0, \dots, 0, 1, 0, \dots, 0]$ with a 1 at position i |
| $\text{diag}(\mathbf{a})$ | A square, diagonal matrix with diagonal entries given by \mathbf{a} |
| a | A scalar random variable |
| \mathbf{a} | A vector-valued random variable |
| \mathbf{A} | A matrix-valued random variable |
| θ | Parameters of a model |
| $f(\theta, \mathbf{x})$ | A function (model) with parameters θ and data \mathbf{x} |
| $\mathbf{A} \odot \mathbf{B}$ | Element-wise (Hadamard) product of \mathbf{A} and \mathbf{B} |

Indexing

| Syntax | Description |
|-----------|--|
| a_i | Element i of vector \mathbf{a} , with indexing starting at 1 |
| $A_{i,j}$ | Element i, j of matrix \mathbf{A} |

Datasets and Distributions

| Syntax | Description |
|--------------------|--|
| \mathbf{X} | The design matrix with dimensionality $n \times p$ with n samples with p features. |
| $\mathbf{x}^{(i)}$ | The i -th training example. |
| $\mathbf{y}^{(i)}$ | The label-vector for the i -th training example. |
| $y^{(i)}$ | The label for the i -th training example. |

Probability Theory

| Syntax | Description |
|---|---|
| $P(x)$ | A probability distribution over a discrete variable. |
| $p(x)$ | A probability distribution over a continuous variable or over a variable whose type has not been specified. |
| $\mathbb{E}_{x \sim P}[f(x)]$ or $\mathbb{E}f(x)$ | Expectation of $f(x)$ with respect to $P(x)$ |
| $\mathcal{N}(\mathbf{x}; \mu, \Sigma)$ | Gaussian distribution over \mathbf{x} with mean μ and covariance Σ |
| $x \sim \mathcal{N}(\mu, \sigma)$ | Gaussian distribution over x with mean μ and variance σ |

Calculus

| Syntax | Description |
|---------------------------------|---|
| $\nabla_{\mathbf{w}} J$ | Gradient of J with respect to \mathbf{w} |
| $\frac{\partial J}{\partial w}$ | Partial derivative of J with respect to w |

Functions

| Syntax | Description |
|--------------------|--------------------------------|
| $\log x$ | The natural logarithm of x . |
| $\ \mathbf{x}\ _p$ | L^p norm of \mathbf{x} |
| $\ \mathbf{x}\ $ | L^2 norm of \mathbf{x} |

Deep Learning

| Syntax | Description |
|--------|---|
| NCHW | The input format of images in PyTorch. N: number of images (batch size), C: number of channels, H: height, W: width |