Workshop 4

COMP90051 Statistical Machine Learning

Semester 1, 2023

Learning outcomes

At the end of this workshop you should:

- be able to explain how the optimisation problems for linear regression and logistic regression differ
- be able to implement logistic regression using the iteratively reweighted least-squares (IRLS) algorithm and gradient descent
- be able to explain benefits/drawbacks of IRLS versus gradient descent

Solving logistic regression

Logistic regression optimisation problem:

$$\mathbf{w}^\star \in \arg\min_{\mathbf{w}} \frac{1}{n} \sum_{i=1}^{n} \ell(y_i, \mu_i)$$

where $\mu_i = \frac{1}{1+\mathrm{e}^{-\mathbf{x}_i^\top \mathbf{w}}}$ and $\ell(y, \mu) = -y \log \mu - (1-y) \log(1-\mu)$

- Can apply gradient descent, but it's slow to converge
- Iteratively reweighted least-squares (IRLS) is faster option:
  - Equivalent to Newton's method (uses the second-order derivative)
  - End up solving a sequence of weighted linear regression problems—interesting connection to last week's workshop!

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