New Book, "The Art of Machine Learning"

and Intro to the qeML Package

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Why Yet Another ML Book?

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Chapter Outline

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- Prologue: Regression problems, illustrated with k-NN
- Prologue: Classification problems, illustrated with k-NN
- Bias, Variance, Overfitting
- Dealing with Large Numbers of Features
- Decision Tress
- Tweaking the Tress
- Finding a Good Set of Hyperparamters
- Parametric Methods: Linear, generalized linear models
- Parametric Methods: Shrinkage-based models
- Parametric Methods: Support Vector Machines
- Parametric Methods: Neural networks
- Image classification
- Time Series and Text

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Recurring Sections: the Bias-Variance Tradeoff

- Supremely important—18,400,000 results to my Google query.
- Yet most books just devote one or two *very vague* sentences to it.
- Sections 1.7, call of Chapter 3, 4.3.6, 6.1, 6.3.5, 9.3.2, 11.10, 13.4
- Example: k-Nearest Neighbors, Section 1.7
  - if k is small, not many neighbors, a small "sample"—hence large **variance**
  - if k is large, some neighbors are quite distant, hence a **bias**; e.g. Y = weight, X = height
- Advantages and disadvantages of parametric models, including polynomial regression.

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Recurring Sections: Pitfalls

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- Sections 1.13, 1.14, 1.15, 1.16, 2.2.1, 2.2.2, 2.2.5, 2.4, 2.7.5, 5.3.1, 11.8, Appendix D
- Example: Random Forests, Setion 5.3.1:
  - NYC taxi data (n=10000 version)
  - potentially 29,315 pickup and dropoff combinations!
  - we aim roughly for $p < \sqrt{m}$;
  - **partykit** package error message, "too many levels"
  - possibly consolidate or even use latitude-longitude embedding

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Statistics vs. CS

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- Old Breiman "Two Cultures" essay still applies.
- Sampling variation vs. "the data."
- E.g. grid search for hyperpaamter tuning includes standard errors.
- Statistics $\Longleftrightarrow$ CS Translator, e.g. *prediction* $\Longleftrightarrow$ *inference*

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The qeML Package

The qeML Package

- On CRAN.
- Independent of the book.
- "Quick and Easy" ML
- Uniform, SIMPLE user interface.
- Various default options.

```
z <- qeRF(svcensus,'wageinc')
```

  One simple call, that's all! No clumsy setup needed.
- "Easy for learners, powerful for advanced users"
- Excellent for teaching:
  - SIMPLE user interface.
  - Many built-in datasets.
  - Includes a number of built-in ML tutorials.