Why Language is Hard: Structure and Predictions

Advanced Machine Learning for NLP

Jordan Boyd-Graber

INTRODUCTION

Today

- What's special about machine learning for NLP
- Layout of the course
- Administrivia
- Perceptron
- Structured Perceptron

Today

- What's special about machine learning for NLP
- Layout of the course
- Administrivia
- Perceptron
- Structured Perceptron
  1. Good ML analysis, standard NLP problem
  2. Often ignored in both classes (except when I teach it)
  3. Uses structure and representation

Most supervised algorithms are . . .

Logistic Regression

Most supervised algorithms are . . .

Logistic Regression

$$p(y \mid x) = \sigma\left(\sum_i \beta_i x_i\right)$$

SVM

Most supervised algorithms are . . .

Logistic Regression

$$p(y \mid x) = \sigma\left(\sum_i \beta_i x_i\right)$$

SVM

$$\text{sign}(\vec{w} \cdot x + b)$$

- What statistical property do these (and many others share)?

Most supervised algorithms are . . .

Logistic Regression

$p(y \mid x) = \sigma(\sum_i \beta_i x_i)$

SVM

$\text{sign}(\vec{w} \cdot x + b)$

- What statistical property do these (and many others share)?
- Hint: $p(y_i, y_j \mid x_i, x_j) = p(y_i \mid x_i) p(y_j \mid x_j)$

Most supervised algorithms are . . .

Logistic Regression

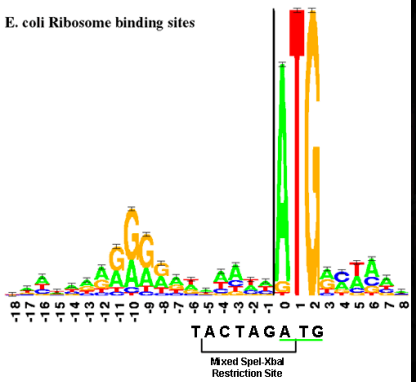
$p(y \mid x) = \sigma(\sum_i \beta_i x_i)$

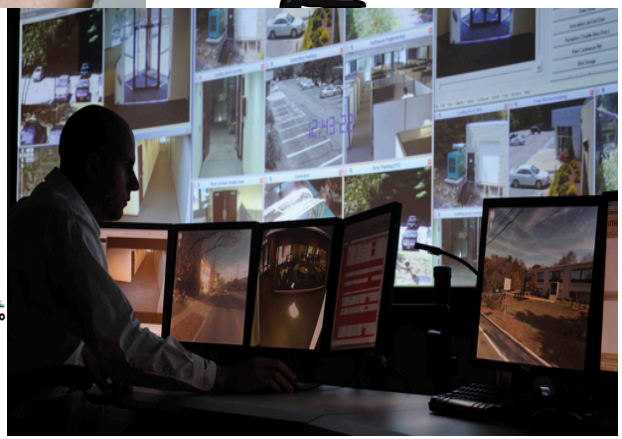
SVM

$\text{sign}(\vec{w} \cdot x + b)$

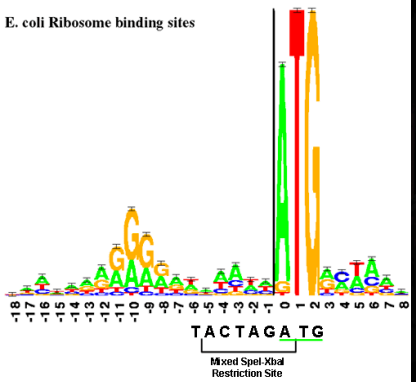
- What statistical property do these (and many others share)?
- Hint: $p(y_i, y_j \mid x_i, x_j) = p(y_i \mid x_i) p(y_j \mid x_j)$
- Independent!

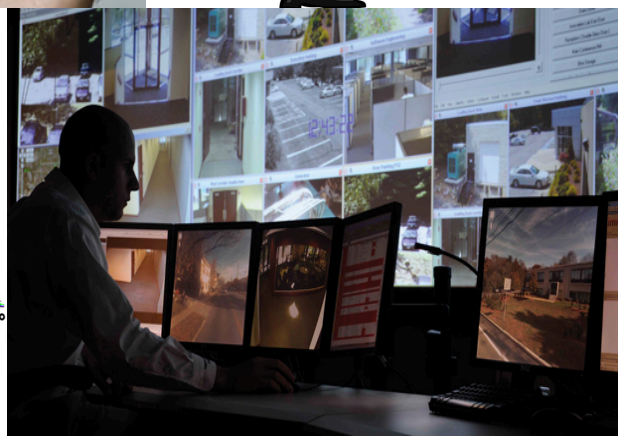
Is this how the world works?





Is this how the world works?





Also particularly relevant for 2016: correlated voting patterns

Why is this ML class different from all other ML classes?

- NLP has very specific applications
- NLP has very specific ML problems
- Much of the skills you need to do ML well are domain-specific
- Culture in ML for NLP research is slightly different than vanilla ML
  - Cleverness is not enough
  - Good baselines are important
  - Simple is usually better