Introduction to Machine Learning

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Welcome to machine learning course, in the era of machine learning!

What is Machine Learning (ML)?

- **Automated learning from data without being explicitly programmed**
- Extracting structure in data
- Could use labeled data instead of pre-specified rules
- Examples: Spam detection, Fraud detection
  Image tagging (annotation)

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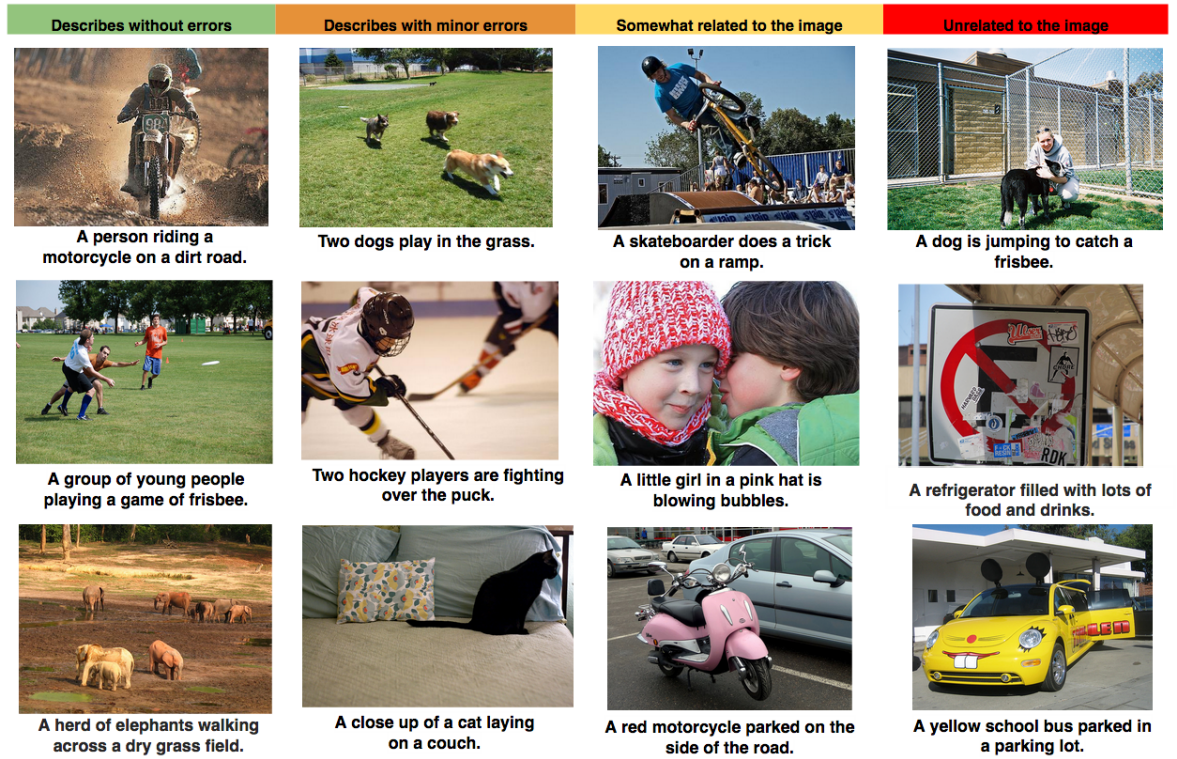

Why study machine learning?

- Data is available in huge quantities. Machines are powerful. Time to extract information!
- Beautiful and **young** field. You could be influential!!
  Many machine learning methods work, but little is known about reasons. Many open problems.
- Cool and useful real world applications: Machine translation, speech recognition, question answering, image recognition, weather prediction, friend suggestion, product recommendation, Handwriting recognition, information retrieval, etc
- **Scientific impact**: Bioinformatics: cancer studies
- **Technological impact**: e.g. Self driving cars

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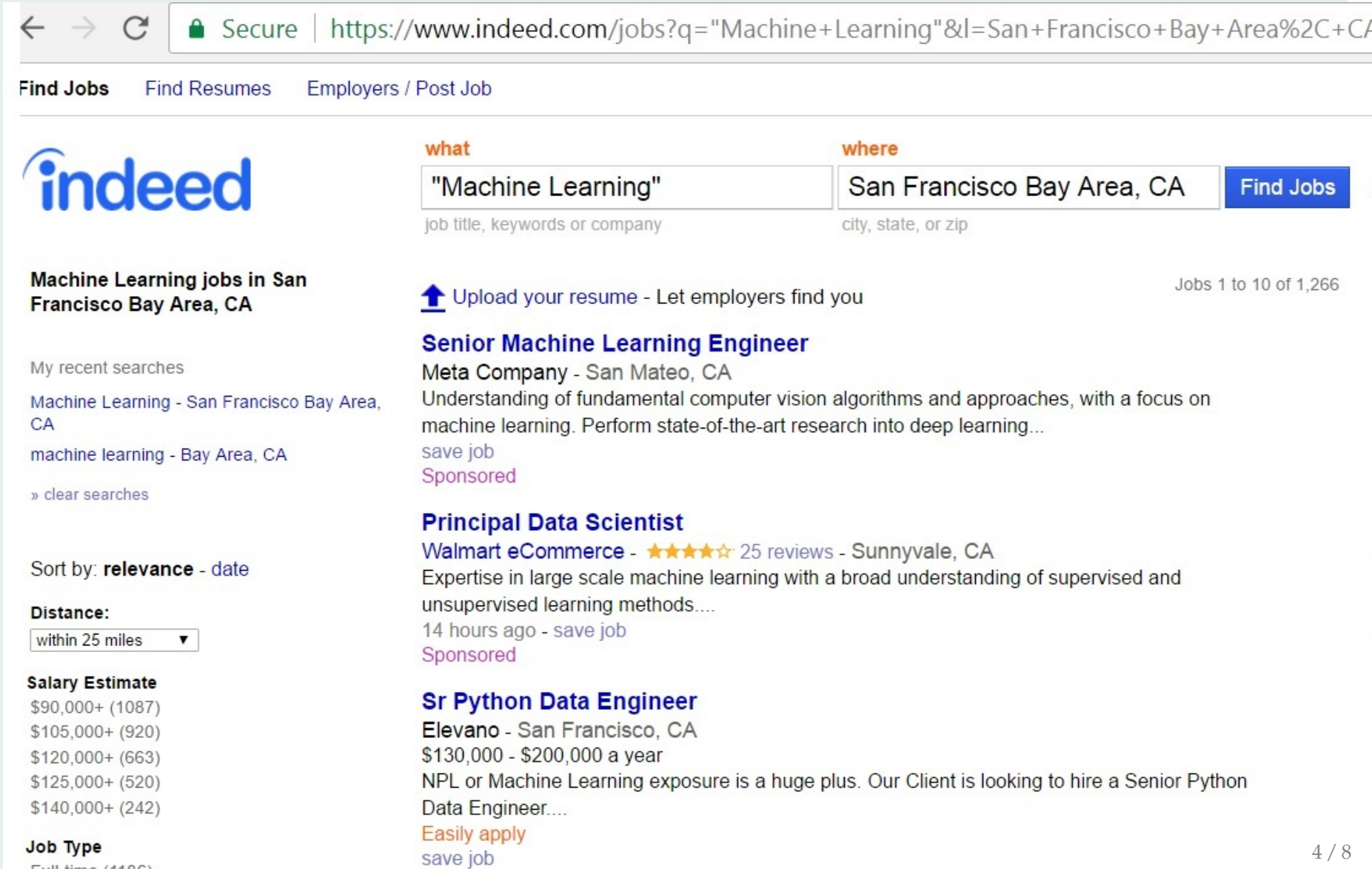
- Great job market for both ML practitioners and researchers.
  Eg: Look around in Bay Area!



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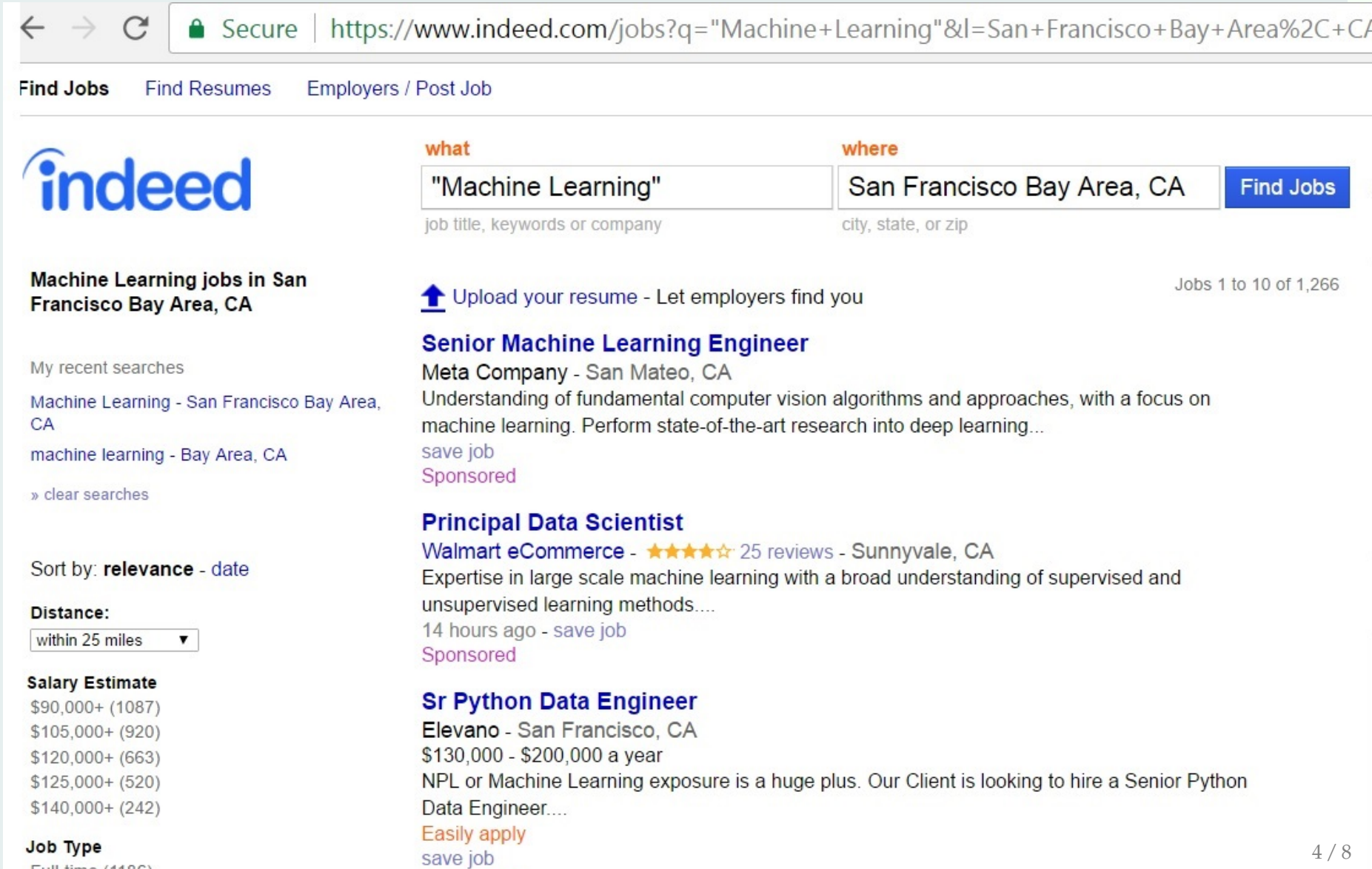


ML is used in other tasks and fields!

Introduction to machine learning could be easy if you know how to start! :-)

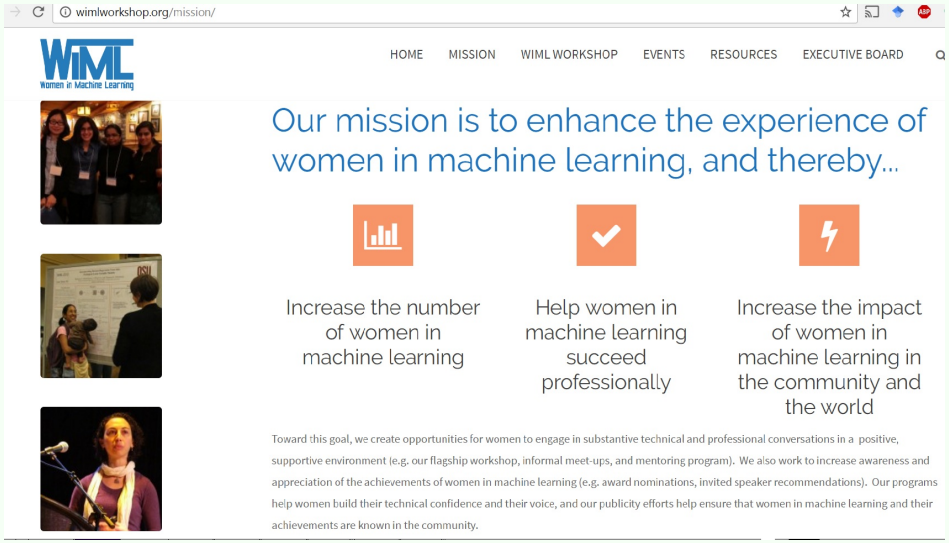
Undergrad is a great time to start a long deep journey to ML!

Build your background and seem smart! Empower yourselves!

- Mathematical skills
  - Multivariate calculus, analysis, functional analysis
  - Linear algebra
  - Convex optimization, numerical optimization, mathematical programming
  - Probability, statistics
  - Scientific computing, numerical analysis
  - Game theory
  - etc
- Computer science and programming skills
  - Correct and fast programming
  - Efficient codes: analysis of algorithms
  - Getting comfortable with tools, parallelization frameworks: MapReduce

More about machine learning

- Statistical vs computational approach
- Recent trend: deep learning!
- Several great online courses, lecture notes, video lectures, tutorials available. **Use them!**
- Several tools and specific languages available: TensorFlow, Julia, Weka, R, Matlab ...
- Women in Machine Learning (WiML)



- Related fields: Natural language processing, Computer vision, Social network analysis, Bioinformatics, ...
- Conferences: NIPS, ICML, COLT, AAAI, IJCAI, ICLR, KDD, ...
  (Many recent sessions video recorded and are available)

Learning tasks

- Supervised learning Learn a model from labeled data, use the learned model to predict for new unseen data

- Unsupervised learning: Capture structure and regularities in data
  No labels
  Find meaningful categories, find anomalies, ...

Think together

How to predict a person's wage at age 45 based on his/her characteristics at age 25?

-What features?
-Input? Type?
-Target (output)? Type?

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