

# CPSC 340: Machine Learning and Data Mining

Conclusion

Spring 2022 (2021W2)

# Admin

- Last class today!
- A6 due tonight
- Final exam updates
  - Lots of TA office hours between April 19-23 (see Google Calendar)
  - Final will be online at the official time: Sun Apr 24 7:00 pm
    - Note: **no Internet** this time! Using it is academic misconduct
  - We'll post more details on Piazza
  - Academic misconduct: it's not worth it.
    - These things often end badly...and we do catch people even in online tests

# CPSC 340: Overview

1. **Intro to supervised learning** (using counting and distances).
  - Training vs. testing, parametric vs. non-parametric, ensemble methods.
  - Fundamental trade-off, no free lunch, universal consistency.
2. **Intro to unsupervised learning** (using counting and distances).
  - Clustering, outlier detection.
3. **Linear models and gradient descent** (for supervised learning)
  - Loss functions, change of basis, regularization, feature selection.
  - Gradient descent and stochastic gradient.
4. **Latent-factor models** (for unsupervised learning)
  - Typically using linear models and gradient descent.
5. **Neural networks** (for supervised and multi-layer latent-factor models).

# Topics from Previous Years

- Slides for other topics that were covered in previous years:
  - [Finding similar items](#): “you may also like” recommendations.
  - [Ranking](#): finding “highest ranked” training examples (Google PageRank).
  - [Multi-dimensional scaling](#): more nonlinear unsupervised models.
  - [Semi-supervised](#): using unlabeled data to help supervised learning.
  - [Sequence mining](#): approximate matching of patterns in large sequences.
- And some bonus lectures from previous years:
  - [Automatic differentiation](#): how to build PyTorch, to do backprop for you.
  - [# of gradient descent iterations](#): theoretical analysis of how long it’ll take.

# CPSC 330 vs. 340

- CPSC 330: Applied Machine Learning.
  - Not intended as a sequel or prequel to 340.
- There is **some overlap** in content, but **focus is different**:
  - More emphasis on the **other steps of the data processing pipeline**:
    - Data cleaning, feature extraction, reproducible workflows, communicating results.
  - More emphasis of “**how to apply ML**”, less on “how ML works”.
- Also some new topics:
  - Time-series data, word embeddings, data preprocessing.
  - Lecture videos available at [https://www.youtube.com/playlist?list=PLWmXHcz\\_53Q2BXsWviGgEqdlSHmfsjSzC](https://www.youtube.com/playlist?list=PLWmXHcz_53Q2BXsWviGgEqdlSHmfsjSzC)

# CPSC 340 vs. 440

- CPSC 440 is now an undergrad course (used to only be 540).
  - Intended as a direct sequel to 340.
  - Basically starting with CNNs and going from there.
- Main focuses:
  - What if  $y_i$  is a sentence or an image or a protein?
  - Giving you the background to understand the latest advances.
- Prerequisites:
  - Expected that you know everything in CPSC 340 and CPSC 320.

# CPSC 440/540 Topics

(Mi Jung will teach in Spring 2023)

- Much more on deep learning (e.g., LSTMs, RNNs, Transformers)
- Kernel methods (e.g., RKHS, two-sample test, MMD)
- Generative models (e.g., generating CIFAR10 images)
  - How do I make “more” samples from this distribution?
- Latent-variable models and inference methods (e.g., EM, variational)
  - (Much) fancier versions of PCA-type unsupervised models
- Markov models
  - Modeling processes that are happening over time
- Probabilistic graphical models
  - Building any big complicated model you want
- Bayesian methods (e.g., Bayesian Neural Networks)
  - How do I incorporate uncertainty every step of the way?

# Other ML-Related Courses

- CPSC 406: Numerical optimization algorithms (e.g. gradient descent).
- CPSC 422: Time series, reinforcement learning (and more).
- CPSC 436N: Natural language processing (340 is a prereq).
- CPEN 400D: Deep Learning (restricted to ELEC and CPEN students)
- STAT 406: Similar/complementary topics.
- STAT 460/461: Advanced statistical issues ('n' goes to  $\infty$ )
- CPSC 532J: Never-ending reinforcement learning (Jeff will teach)
- CPSC 532D: Modern Statistical Learning Theory
- CPSC 532S : Topics in Artificial Intelligence: Vision & Language
- CPSC 532V: Advanced natural language models (using common-sense reasoning).
- CPSC 532W: Probabilistic programming (better to take 440 first).
- CPSC 532P / 538L: Privacy in ML (Mi Jung will teach).
- CPSC 538L: Causal Inference in ML
- CPSC 533R, 533V, 533Y: Deep learning for computer graphics and robotics.
- EECE 571F: Deep learning with structure (restricted to grad students)
- EECE 592: Deep learning and reinforcement learning.
- MATH 605D: Causality+graphical models (sometimes) / tensor decompositions (other times).
- STAT 520A: Bayesian analysis (incorporating uncertainty).

[CAIDA events](#)

[ML Reading Group](#)

Also: more AI courses at <https://caida.ubc.ca/index.php/teaching>



(pause)

# Course evaluations

- We'll now take 10 min for you to fill out the course evaluations.
  - We care deeply about your education, so we take them very seriously
  - You will be able to evaluate the class overall, and then Mijung and Jeff separately
  - Please use the text boxes to also let us know about the “lecture specialization experiment” [where we each specialized in half the lectures]
  - As always, please remember we're real people, so both praise and critical feedback are great. Please avoid personal, hurtful, or unconstructive negative comments. In other words, please be professional.
- Link: <https://seoi.ubc.ca/surveys>

(pause)

# Grad School Advice / FAQs

- Don't do it! – Mike G
- Do it! (but maybe later) – Jeff C
- Get work experience: co-op, full-time after undergrad, grad school internships
  - Build skills, confidence, awareness of what's out there, and *boredom* (or curiosity)
- Try for some research experience before grad school, if you can
  - Very helpful for getting in, but also vital for *knowing if you want to do it*
- Research Master's vs. Professional Master's
  - Research Master's (pays you): reading/writing papers, inventing things, leads to PhD
    - Straight to PhD (pays you): more-or-less default in US, unusual in Canada/Europe
  - Professional Master's (you pay): practical skills to get you a job, leads to industry
- Canada is a world leader in ML (but maybe think about US/Europe/... too)
- If you go, remember: the system is terrible, some advisors are a bad fit (or just bad), you're not an imposter, and leaving/taking breaks is not failing

# Grad School Applications Advice

- Do interesting side-projects and post them on your GitHub profile (also great for industry)
- Make a personal website and/or blog (also great for industry)
- For a research Master's, prior ML research experience is a *huge* boost to your application
  - But it's hard to come by, because so many undergrads want to do ML research
  - Possible path: excel in ML course(s), become a TA, excel as a TA, do a summer research internship
- Pick your referees carefully
  - Knows you well in an academic/professional context >> is famous
  - Try to gauge if the person is enthusiastic about writing the letter
- Consider (also) applying to “ML-adjacent” programs/advisors
- If there's something that needs explaining (e.g., low grades), explain it!
- Personal contact with potential advisors can help
  - But we get *flooded* with generic emails, so only do it if you put the effort in
- Next steps at UBC:
  - Take CPSC 440 and other courses mentioned earlier
  - TA for ML courses (CPSC 340, 330, 440, etc)
  - Get work experience, do projects

# Unsolicited General Life Advice - Now

- Try to find an intersection of work you enjoy and careers with enough jobs
  - It's up to you to determine both of those things
  - Do your own research, make your own decisions
  - Don't let your parents influence you too much
- Don't *unnecessarily* obsess over grades (gamification)
  - You should know *why* you need good grades; they are not worth anything inherently
  - They do not reflect the skills needed for success (not even close)
  - Don't measure peoples' worth by grades: having a C+ vs. A+ GPA doesn't make you "inferior" or "superior"
- Make sure you're happy in the present moment
  - Don't sacrifice current happiness / mental health because you're "working towards something"
  - You should enjoy university!
- Don't assume the system makes sense
  - For example, undergraduate achievement has little to do with graduate school or research achievement
  - Your education may not focus on the skills you need to succeed in 2021-2100 (we try, but it's hard)
  - Older or more "senior" people (like me) can be wrong!
- You are lucky
  - UBC is one of the best schools in Canada, and Canada is a great place to be
  - But all of the above applies no matter where you are!

# Unsolicited General Life Advice - Future

- Some (many? most?) of you will find yourselves in positions of power one day
  - As parents
  - As supervisors/managers at work
  - As educators (like me)
- Try to remember the feeling of being on the powerless end of power dynamic
  - It can be easy to forget sometimes
  - Though sometimes, it can be hard to forget...
- When the time comes, try to be compassionate and humble
  - Try to remember that feeling!
  - A little thing you say might leave someone in a panic or reading into your wording for days
- It is complicated to assign blame
  - If someone is “lazy” or “flaky” is that their fault? What is their story?
  - Our culture of “meritocracy” is generally not very sympathetic...
- Likewise, it is complicated to assign credit
  - How did I get into this position of power as a prof? Did I “earn” it? That’s a complicated question.
- As UBC students, you are probably likely to hold positions of power
  - We will each have our own philosophy on the above issues
  - But hopefully we can agree on the value of compassion



Talia Ringer  
@TaliaRinger

kind mediocrity > cruel genius

# The End (Sec201)

---

- This is the last slide of the course!
- Good luck with everything!!!!

- This is the last slide of the course!
- Good luck with everything!!!!

3D CGI render of a young redheaded male professor thanking the class on the last day





# The End(Sec202)

- This is the last slide of the course!
- Good luck with everything!!!!

3D CGI render of a korean female professor thanking the class on the last day



Report issue

