

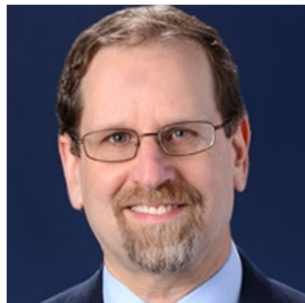
# GETTING STARTED: COMPUTER SCIENCE INDEPENDENT WORK

FALL 2023

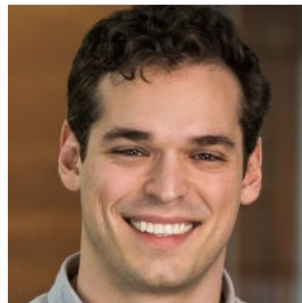
DR. ROBERT FISH, DR. ZACHARY KINCAID,  
MIKKI HORNSTEIN, & KOBİ KAPLAN

# WELCOME!

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## OUTLINE FOR THIS SESSION

- Outstanding IW Awards – Spring 2023
- Overview of independent work in Computer Science
- Details of important steps and deadlines
- Resources for more information and help



# CONGRATULATIONS!

## Spring 2023 Outstanding Independent Work

### **Sarah Bock**

Using Domain Adversarial Neural Networks (DANN) to Reduce Human Bias in Classification Algorithms

Adviser: Olga Russakovsky

### **Ananya Grover**

Studying the Impact of "Rhythm Bots" on Human Motion, Emotional Valence and Arousal, and Brainwave Entrainment

Adviser: Naomi Leonard

### **Michelle Huang**

Improving Language Model Consistency through Sparsity Activation Regularization

Adviser: Suma Bhat

### **Saumya Malik**

Unsupervised Learning of Sparse Lexical Retrievers

Adviser: Danqi Chen

### **Marina Mancoridis**

The Price Is Right, or Is It? A Data-Driven Approach to Understanding Individual Decisions Under Risk

Adviser: Tom Griffiths

### **Archie McKenzie**

Histories.ai

Adviser: Brian Kernighan

### **Andrew Tao**

Nested Data Parallelism using Parallel Sequences in OCaml

Adviser: Andrew Appel





**LET'S GET  
STARTED!**



# What Is Independent Work?

## ■ Independent Work (IW):

*An individual project to study an idea in depth.*

## ■ Examples:

- ▷ Algorithm
- ▷ System design
- ▷ Problem formulation
- ▷ Benchmark suite
- ▷ Proof of a theorem
- ▷ Application
- ▷ Investigate a dataset
- ▷ Etc...



# Why Do Independent Work?

- Study a topic in depth
  - ▷ Dive into much more detail than is possible in a course
- Learn important skills
  - ▷ Technical writing, speaking, project management
- Work closely with faculty
  - ▷ Meet weekly, get advice, get to know them, etc.
- Do something interesting to talk about in...
  - ▷ Grad applications, job interviews, etc.
- Have fun!!



# Types of Independent Work

## ■ Fall One-Semester Project

- ▷ Some BSE juniors/seniors
- ▷ Designed for one term, but can be followed by a related project in a later semester
- ▷ IW seminar, or one-on-one/individual advising

## ■ Two-Semester/Thesis

- ▷ All AB seniors and some BSE juniors/seniors
- ▷ Designed for a full year
- ▷ One-on-one/individual advising





## IW Seminars

- Same as one-on-one projects, but students work on related topics and meet with an advisor together.
  - ▷ Enables collaborative projects
  - ▷ Enables sharing of infrastructure
  - ▷ Enables feedback to/from other students
- Targeted at first-time IW students
  - ▷ Provides more help on how to choose good projects, how to manage time, how to design talks, how to write papers, etc.



## Important Steps and Deadlines: Fall 2023 Projects

- September 27: Written Project Proposal due, 11:59pm
- September 28: SEAS Funding Application due
- October 25: Checkpoint Form due, 11:59pm
- November 7: Attend How to Give an IW Talk
- December 5: Attend How to Write an IW Paper
- December 10: Oral Presentation Slides & Link to Video due, 11:59pm
- January 11: Written Final Report due, 11:59p

<https://www.cs.princeton.edu/ugrad/independent-work/important-steps-and-deadlines>



## Important Steps and Deadlines: Two-Semester/ Thesis Projects, Fall 2023

- September 27: Written Project Proposal due, 11:59pm
- September 28: SEAS Funding Application due
- October 25: Checkpoint Form due, 11:59pm
- November 7: Attend How to Give an IW Talk
- December 5: Attend How to Write an IW Paper
- December 7: Mid-Year Progress Report due, 11:59pm

<https://www.cs.princeton.edu/ugrad/independent-work/important-steps-and-deadlines>



## Important Steps and Deadlines: Two-Semester/ Thesis Projects, Spring 2024

- February 15: SEAS Funding Application due
- February 22: Written Draft Paper due, 11:59pm
- February 28: Thesis Second Reader due, 11:59pm
- March 26: Attend How to Give an IW Talk
- April 9: Attend How to Write an IW Paper
- April 18: Thesis Final Written Paper due, 11:59pm in
- April 21: Oral Presentation Slides due, 11:59pm
- April 22-26: Oral Presentation Week (schedule a time with your adviser to give a live oral presentation)
- April 28: Two-Semester Junior Written Final Report due, 11:59pm

# QUESTIONS SO FAR?



**Onto the  
specifics...**



# Written Project Proposals

(All IW & Thesis Students)

- Submit a written description of your project plan
- Logistics:
  - ▷ Due September 27, 11:59pm Eastern
  - ▷ 1-2 page paper
  - ▷ Submit PDF document via IW portal



# Written Project Proposal (Continued)

- Motivation and goal
  - ▷ “The goal of my project is...”
- Related work
  - ▷ Survey of prior work with similar goals
- Approach
  - ▷ Key novel idea
- Implementation plan
  - ▷ Things you plan to implement
- Evaluation Plan
  - ▷ Experiment design, data, metrics, comparisons





# Checkpoint Form

(All IW & Thesis Students)

- Write a short summary of what is done in the first half, and what is planned for the second half
- Logistics:
  - ▷ Due October 25, 11:59pm EDT
  - ▷ Write two paragraphs
  - ▷ Submit via IW portal
  - ▷ Get feedback from advisor

Checkpoint Form - Comp: X

← → ↻ 🏠 🔒 <https://iw.cs.princeton.edu/portal/student/submissions/229/checkpoint> ☆ S ☰

## Checkpoint Form

Please refer to [independent work website](#) for more information about this form.

**Name \***

**Advisor \***

**Project title \***

**Approximate number of meetings with your advisor \***

**Progress report \***

Progress to date: ← **Progress to date:**

---

Current difficulties: ← **Current difficulties:**

---

Next steps: ← **Next steps:**

---

**Submit**



# Oral Presentation

(Fall Semester Students Only)

■ Give a **nine-minute** talk about what you've done over the whole semester

- ▶ Required for all seminar students, and any first-time BSE students.

■ Logistics:

- ▶ Attend “How to Give an IW Talk” on November 7
- ▶ Submit slides and video link via IW portal by December 10 at 11:59pm
  - ▶ Note: You must submit your FULL slide deck by the deadline above

## Oral Presentation (Continued)

- Video-recorded oral presentations
  - ▷ Record your oral presentation via Zoom, or
  - ▷ Select another way to record your oral presentation (Loom, etc.)
- Save your recording either on Zoom or in Google Drive
  - ▷ Submit a **link** to your recording to the IW portal
- Submit a pdf of your slides to the IW portal
- Seminar students: your instructor may ask you to practice or present in your group meeting, as well
- One-on-one students: your adviser may ask you to present to their research group, as well

## Oral Presentation (Continued)

- Motivation and goal
  - ▷ “The goal of my project is...”
- Related work
  - ▷ Survey of prior work with similar goals
- Approach
  - ▷ Key novel idea
- Implementation plan
  - ▷ Things you implemented. How did you do it? What remains to be done?
- Evaluation
  - ▷ Experiment design, data, metrics, comparisons, qualitative results, quantitative results, further results needed
- Discussion
  - ▷ Conclusions, limitations, future work



# Written Final Report

(All IW & Thesis Students)

- Submit a written description of your project, including results and conclusions

## Fall Semester IW

- Due January 11 by 11:59pm
- Attend “How to Write an IW Paper” on December 5
- Submit PDF via IW portal
- 20-25 pages, double-spaced, plus appendix

## Senior Thesis

- Due April 18 by 11:59pm
- Attend “How to Write an IW Paper” on December 5 or April 9
- Submit PDF via IW portal
- 40-50 pages, double-spaced, plus appendix

## Two-Semester Junior IW

- Due April 28 by 11:59pm
- Attend “How to Write an IW Paper” on December 5 or April 9
- Submit via IW portal
- 40-50 pages, double-spaced, plus appendix

**Final papers submitted after 11:59pm on the due date will be assigned a 1/3 grade deduction.**



# Written Final Report (Continued)

## Motivation and goal

- ▷ “The goal of my project is...”

## Related work

- ▷ Survey of prior work with similar goals

## Approach

- ▷ Key novel idea

## Implementation

- ▷ Things you built. How did you do it? ~~What remains to be done?~~

## Evaluation

- ▷ Experiment design, data, metrics, comparisons, qualitative results, quantitative results, ~~further results needed~~

## Discussion

- ▷ Conclusions, limitations, future work

# **Additional Requirements for Two-Semester/ Thesis Students**





# Draft Paper

(Two-Semester/Thesis Students Only)

- Submit a draft for at least the first few sections of your report and an outline for the remainder
- Logistics:
  - ▷ Due February 22, 11:59pm Eastern
  - ▷ At least 4-5 pages, single-spaced
  - ▷ Submit PDF document via IW portal



# Second Reader Form

(Thesis Students Only)

- Select a member of the Princeton faculty to be a second reader on your project
  - ▷ Second readers review your project and provide input on your grade
  - ▷ If your primary adviser is not a COS faculty member, your second reader **MUST** be a COS faculty member
- Logistics:
  - ▷ Due in IW portal on February 28, 11:59pm Eastern
    - ▷ Start asking early!

## Second Reader Form

Please refer to [independent work website](#) for more information about this form.

**Name\***

**Advisor\***

**Project title\***

**Who will be your second reader?**

Note that your second reader will receive an email letting them know you selected them.

☐ My second reader is not listed above

☐ I confirm that my second reader has agreed to be a second reader for my thesis (you must get confirmation before submitting this form)

Submit

<https://iw.cs.princeton.edu/portal>



## Spring Oral Presentation (Two-Term/Thesis Students Only)

- Give a live **12-minute** talk about what you've achieved over the course of the year
  - ▷ Required for all two-semester and thesis students
- Logistics:
  - ▷ Slides due in IW portal on April 21, 11:59pm
    - ▷ Oral Presentations Week, April 22-26
    - ▷ Set up a time to present live, in-person, to your adviser.



## Spring Oral Presentation, Continued (Two-Term/Thesis Students Only)

### More Logistics:

- ▶ Counts as Senior Departmental Exam for AB Seniors
- ▶ Attend “How to Give an IW Talk” on November 7 or March 26
- ▶ Utilize campus resources such as McGraw Center and Princeton Writes



## Spring Oral Presentation, Continued (Two-Term/Thesis Students Only)

### Motivation and goal

- ▶ “The goal of my project is...”

### Related work

- ▶ Survey of prior work with similar goals

### Approach

- ▶ Key novel idea

### Implementation plan

- ▶ Things you implemented. How you did it? What remains to be done?

### Evaluation

- ▶ Experiment design, data, metrics, comparisons, qualitative results, quantitative results, further results needed

### Discussion

- ▶ Conclusions, limitations, future work

## **Additional Important Information**

<https://iw.cs.princeton.edu/portal>

## Manage your independent work

Fall 2023
Project Title <input type="text"/> (Edit)
Advisor August, David
Written Proposal <a href="#">→ Submit File</a> Due: 2/20/2023 11:59 pm
Checkpoint Form <a href="#">→ Click to complete form</a> Due: 2023-03-11
Oral Presentation <a href="#">→ Submit File</a> Due: 4/16/2023 11:59 pm
Oral Presentation Video Link <a href="#">→ Click to complete form</a> Due: 4/16/2023 11:59 pm
Written Final Report <a href="#">→ Submit File</a> Due: 5/1/2023 11:59 pm





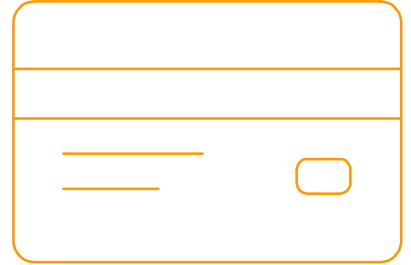
# Funding

## ■ Project-related expenses:

- ▶ Unusual hardware, software, data sets, etc.

## ■ Available funds:

- ▶ School of Engineering and Applied Science
  - ▶ Requires an adviser signature, **don't procrastinate!**
- ▶ Support up to ~\$500 or more with justification (\$300 max for cloud computing services)
- ▶ Open to ANY computer science student
- ▶ Student Activities Funding Engine (SAFE)
  - ▶ <http://www.princeton.edu/studentfunding>





# Collaboration

## ■ **INDEPENDENT** Work

- ▷ Every student must do their own project

## ■ Collaboration

- ▷ Multiple IW projects can be synergistically part of a larger effort, either with other IW students, or grad students
- ▷ Each student must carve out a distinct part with a clear goal, novel idea, evaluation methodology, etc.
- ▷ Each student must submit their own work
- ▷ Each student will be graded separately



# Grading

- IW must be taken for a grade
- Grades are recommended by instructor, confirmed by IW Coordinators
- Grades will depend upon:
  - ▶ Student initiative and contribution: the creativity and originality of student ideas and/or degree of technical challenge undertaken
  - ▶ Student progress: content, amount of work accomplished to date, clarity and polish of presentations
  - ▶ Student presentation and paper: content, eloquence, organization and clarity



## Grading (Continued)

- Majority of grade will depend upon quality of work
  - ▶ But, poor presentation and/or missing checkpoints will also have an impact
- **Final papers submitted after 11:59pm on the due date will be assigned a 1/3 grade deduction.**



# Grading (Continued)

## A-level

- ▶ Clear contribution – interesting, creative
- ▶ Solid execution and results – refined and tested
- ▶ Excellent talks, papers – thoughtful, thorough
- ▶ Student has taken initiative and led project

## B-level

- ▶ Not-so-innovative – possibly obvious from previous work
- ▶ Working execution and results – not fully refined and tested
- ▶ Complete papers and talks – limited insights



# Grading (Continued)

## ■ C-level




- ▷ Not innovative
- ▷ Unfinished or not working implementation
- ▷ Report looks like workbook or lab report

## ■ D-level

- ▷ Nothing interesting attempted, nothing gained
- ▷ Report is stream of consciousness



## Common Mistakes

-  Mistake: Delaying project planning until last minute
  - ▶ Instead: Get started right away
-  Mistake: Postponing meetings with your advisor
  - ▶ Instead: Try to meet once a week, even if it's a brief meeting
-  Mistake: Allowing yourself to get stuck
  - ▶ Instead: Talk to your advisor; don't avoid them when you are stuck
  - ▶ TA's are assigned to every seminar. Use them!



## Common Mistakes (Continued)



Mistake: Putting off work until the end of the semester

- ▶ Instead: Work consistently during the semester (10 hours per week, minimum)



Mistake: Preparing papers and presentations at the last minute

- ▶ Instead: Iteratively refine. Get feedback from your advisor.





## If You're Having Trouble...

- Examples:
  - ▷ If you expect to miss a deadline
  - ▷ If you have problems with your advisor
  - ▷ If you have problems with your project
  - ▷ Other factors in your life (e.g. illness, death in the family, etc.)
- If you tell us early, we might be able to help you
  - ▷ We can direct you to the right person
- Fixing problems post facto may be much harder
  - ▷ Often involves Deans, etc.

A large, light blue speech bubble with an orange outline, containing the text 'LET US KNOW!'.

**LET US  
KNOW!**



# Who/What You Can Ask

## ■ Your Advisor:

- ▶ Anything research related
- ▶ Not: “Can I skip the project proposal or final paper?”

## ■ IW Coordinators (Dr. Fish, Dr. Kincaid)

- ▶ Anything about mandatory requirements
- ▶ Not: “Is this research interesting?”

## ■ IW Administrator (Mikki Hornstein)

- ▶ Anything about dates, forms, funding, etc.
- ▶ Not: “Can you give me an extension?”

## ❓ How to Ask Questions

### ■ Canvas/Ed – Primary Resource

- ▶ <https://princeton.instructure.com/courses/12708>
- ▶ Ask IW staff and other students questions about logistics, advice, toolkits, data sets, etc.

### ■ Email Mikki

- ▶ mhornstein (@princeton.edu)



## Where to Find More Information

### ■ IW Website:

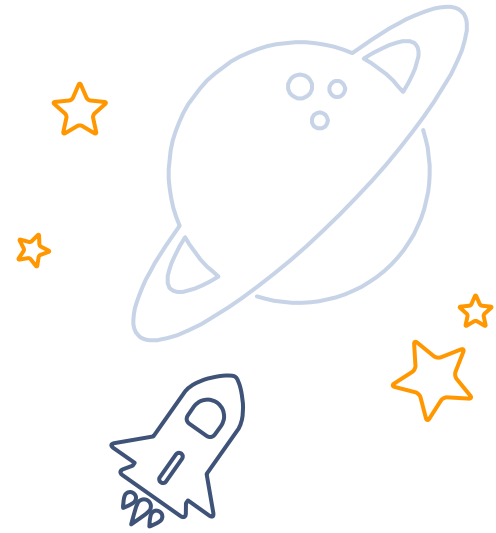
- ▷ <http://www.cs.princeton.edu/ugrad/independent-work>
  - ▷ Important Steps and Deadlines
  - ▷ Guidelines and Useful Information

■ Note: These slides will also be available on the website and Canvas



# That pretty much covers it.

Let's summarize the key points...





## Immediate Next Steps

- Look over the IW website, and be aware of important upcoming deadlines
  - ▷ Important Steps and Deadlines
  - ▷ Guidelines and Useful Information
- One-on-one students: Schedule weekly meetings with your advisor



# What to Do in September/October?

- Work diligently to develop your project plan
  - ▷ Work hard to define a specific goal
  - ▷ Understand all related work
  - ▷ Articulate what makes your project novel
  - ▷ Know what software and data you will use
  - ▷ Have a good idea of what you need to implement
  - ▷ Have a specific plan to evaluate your results
- Write your project proposal early, get feedback, and refine multiple times.



## But the Semester Just Started!

- The first few weeks are really important...
  - ▷ A good project plan is key to success
  - ▷ It takes time to understand related work, relevant software, and available data sets
  - ▷ It take iteration and refinement (multiple meetings with your advisor) to define a good project goal and novel approach
  - ▷ Working hard in the first few weeks greatly reduces the chances of ending up with a weak project





## My Thoughts on IW at Princeton

- This is your chance to do an in-depth project on a novel topic of your own choosing
  - ▷ It doesn't get better than this
  - ▷ It's probably why you came to Princeton
  - ▷ It's certainly what you'll remember most from your academic career at Princeton
- Take the initiative and BE AWESOME!



# THANKS!

**Any questions?**