

Final Project (30 pts for the final grade)

1. Timeline

- ~~• [9/30] Team sign-up~~
- ~~• [10/11-10/14, in-person] Proposal check-in (1 pt)~~
 - ~~• Schedule a 5-15 min chat with Prof. Wei for each team~~
- ~~• [10/18] Proposal due (1 pt)~~
 - ~~• As long as your proposal is approved, you will get the full credit for this part of the evaluation.~~
- ~~• [11/1] Data preparation check-in (1 pt)~~
- ~~• [11/16] Model development check-in (1 pt)~~
- ~~• [12/07-12/08, in-person] Draft 5-page slide check-in (2 pts)~~
 - ~~• Task~~
 - ~~• Previous work/Challenges~~
 - ~~• Method: MLOD~~
 - ~~• Initial result~~
 - ~~• Plan~~
- [12/09] Final 10+ page slide due (3 pts):
 - ~10 slides: focus on the content and no need to make the style/icon fancy
 - For each slide (except title), make footnote about the author
 - Intro:
 - What's the task
 - Motivation: what's the impact
 - What's the challenge
 - **Solution (each team member)**
 - What's your solution
 - What's the initial results (okay to be negative, but need analysis on why it's bad)
 - Future plan
 - Bullet points for each member
 - Feel free to send me your early drafts for feedback
 - Talk guide [\[link\]](#)
- [12/19] **Final report/Source code (20 pts).**
 - You'll be graded by your individual contribution. Thus, make sure to list the contribution clearly
 - For the code and report, we will have grades = {10, 8, 6, 4} for A/B/C/D
- [12/19] **Reflection (1 pt).**

3. Instruction on the project proposal

([example](#), need to add literature review)

Proposal: The proposal report should follow the **CVPR** format (LaTeX template can be downloaded [here](#)). Your report should be no longer than **one page** (excluding references).

You need to have the following sections:

- **Introduction:** Please describe the motivation for your work. Be specific about the problem you are solving. Is it an interesting/significant problem? What are your contributions?
- **Related work: Literature review and code**
- **Planned milestones:** Please describe the milestones to make to complete your project (e.g., data collection, model training)
- **Labor division**

4. Instructions on the final code/report

[10 pts] Github code: create a github repo. In the README.md

1. **Runnable scripts/commands:** what are the main commands that you run to get the results
2. **Contribution:** who is responsible for which files

[10 pts] Final report ([example](#)): The final report should follow the **CVPR** format (LaTeX template can be downloaded [here](#)). Your report should be no longer than **four pages** (excluding references/contribution). Please make sure that it contains the following sections. (create an [Overleaf](#) account and upload the latex template to your new project):

1. ~~(no need for abstract)~~
2. **Introduction:** Please describe the motivation for your work. Be specific about the problem you are solving. Is it an interesting/significant problem? What are your contributions?
3. **Related work:** What has been done previously? What's the strength/weakness of previous approaches? How are those work connected to the approach you are studying?
4. **Method:** Please describe the details of your approach. If it's about neural network architectures, please include a figure. If it's an algorithm, you may want to include a pseudocode (see [here](#)). Feel free to include both if you feel necessary.
5. **Experiments:** What is the data that you are using? What are the hyperparameters? How is the model evaluated? What are the baseline approaches that you are comparing your method with? How does the performance of your method compare with these baseline methods? Tables and figures are efficient ways to convey your experiment results.
6. **Conclusions:** Please include the most important take-away message. This can be one paragraph about the reproducibility of the work, the strength/weakness of your method compared against baseline methods, and future work that can be done.
7. **Contribution: clearly list out who wrote on what section. Add Github repo link.**
8. **Reference:** https://www.overleaf.com/learn/latex/Bibliography_management_with_bibtex

[1 pt] Reflection (each person): It should be technical and concise.

- [0.2 pt] Which tasks did you work on? (e.g., dataloader, model)
- [0.2 pt] What's your biggest challenge in the project?
- [0.2 pt] How did you address the challenge?
- [0.2 pt] What did you learn from the final project? (What could have been done better?)
- [0.2 pt] What's your self-evaluation for code and report? A, B, C, or D? Why

5. Tutorial on GPU machines

- Find which GPU machine you are assigned to on the spreadsheet [\[link\]](#)
- Login
 - Suppose you are assigned to gpu01, on your browser enter: <http://cscigpu01>
 - Login on the jupyterhub page
- Usag
 - You can create a **new terminal** to
 - Change your password
 - Git clone repos
 - Create new conda environment (unlike Google Colab, you need to install your own packages)
 - Create a new env: **conda create -n env_name**
 - Activate the env: **source activate env_name**
 - Install packages: **conda install xxx**
 - **conda install ipython ipykernel**
 - Create the jupyter notebook kernel (while the env is activated): **ipython kernel install --name "jupyter_display_name" --user**
 - Refresh jupyterhub page and when you create new notebook, you'll see the choice of using kernel **"jupyter_display_name"**
 - You can create a new notebook to interactively work on your project

2. Brainstorming for project ideas [\[team sign-up\]](#)

Thanks to our wonderful BC faculties, below is a pool of interdisciplinary problems to be solved with biomedical image analysis methods. These project ideas are meant as starting points and please formulate the project that excites you through further discussions with them.

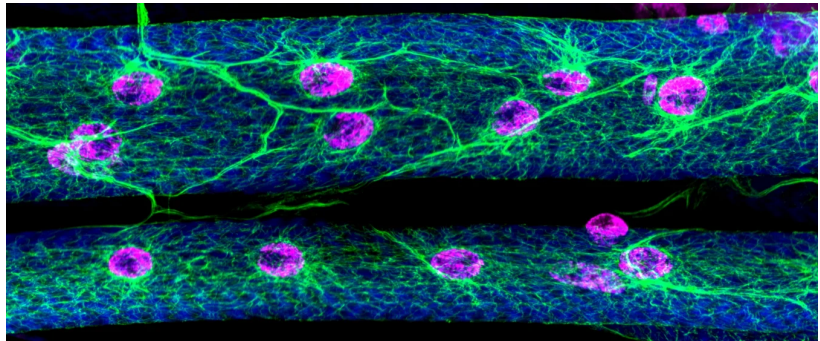
	1. Nucleus and muscle segmentation - Motivation: Our research focuses on the roles of the nucleus in orchestrating developmental and cellular processes. Specifically, we investigate the
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[Prof. Eric Folker](#)
(BIO)

mechanisms that regulate nuclear movement in skeletal muscle and the impact of such movements within the context of myogenesis, muscle function, and muscle disease pathogenesis.

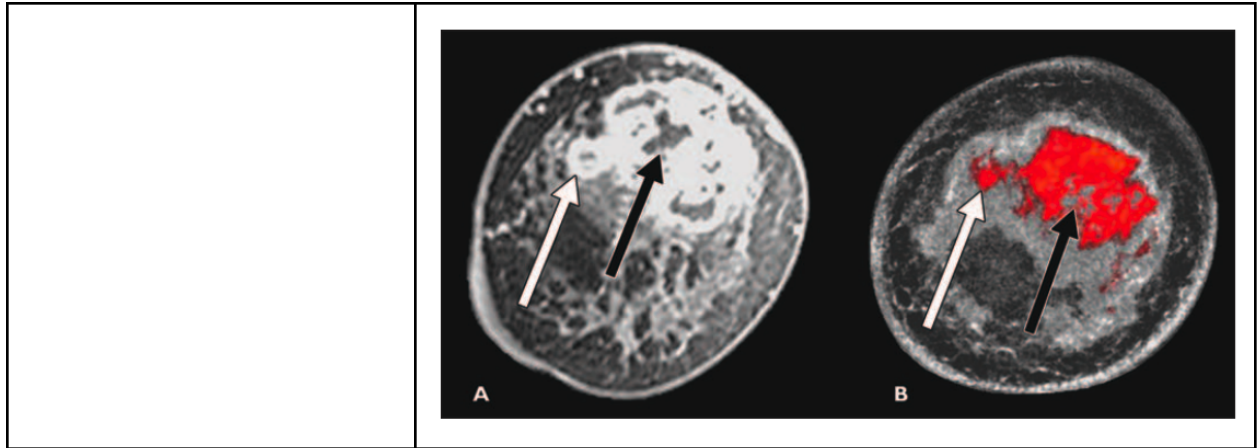
- **Project 1:** Nucleus and muscle segmentation. The goal is to automate the analysis of where the many nuclei are within single muscle.
- **Project 2:** Microtubule and muscle segmentation. We have a growing interest in more precisely defining the orientation and density of microtubules within muscle cells.

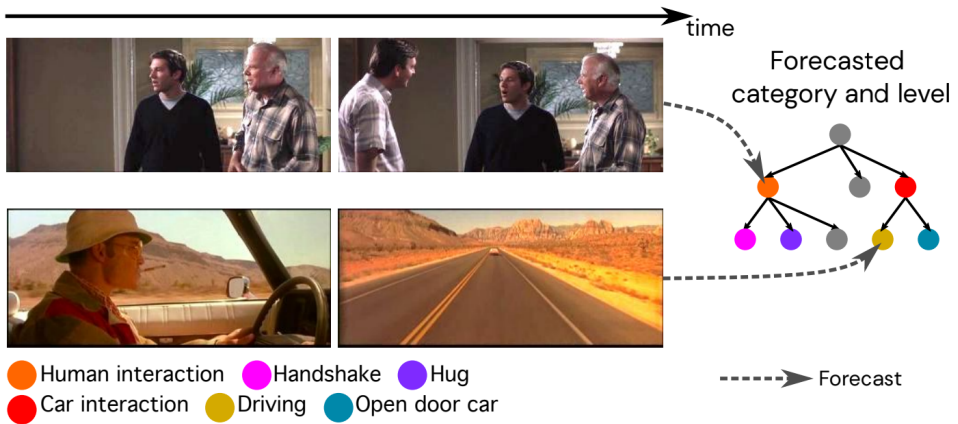


[Prof. Bryan Ranger](#)
(Engineering)

1. Ultrasound image analysis

- **Motivation:** Due to the arise of the low-cost hardware, ultrasound imaging has been playing a major role global public health, especially in resource-constrained regions. There is much need in developing AI methods to effectively train practitioners and interpret the images.
- **Project 1:** CV-based feedback to train practitioners. It's not easy to use the ultrasound equipment properly. There are many CV-based feedback system to help train sporting playing. Can you develop one to train doctors, especially in the resource-constrained regions?
- **Project 2:** Ultrasound image prediction. Well, the million-dollar question: how to diagnose various kinds of disease (or nutrition!) from ultrasound images?



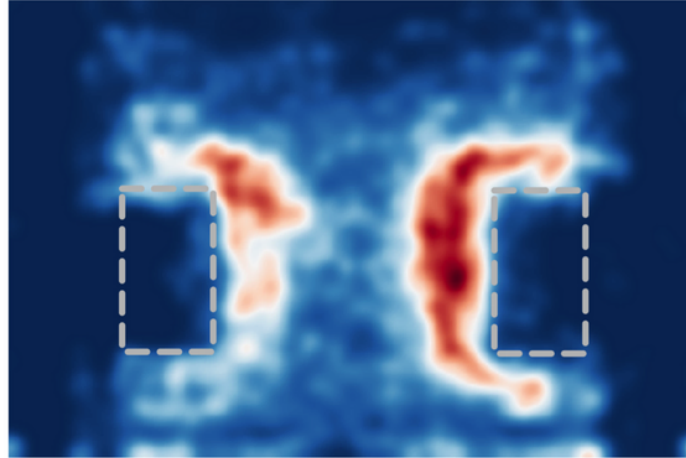
Mentor	Project ideas
 Prof. Stefano Anzellotti (PSYC)	<u>1. Acquisition of person knowledge</u> - Motivation: we aim to investigate how recognizing individuals and observing their actions in specific contexts can lead to the acquisition of knowledge about them such as their preferences and beliefs. Also, we are modeling the acquisition of person knowledge from more complex stimuli (e.g., videos) using deep networks. Check out the recent review paper [link] - Project 1: video future prediction with structured psychology knowledge. There are many future prediction papers based on machine learning techniques, e.g., [link]. Can we build a more robust and interpretable model by specifically modeling the psychology parameters?  ● Human interaction ● Handshake ● Hug ● Car interaction ● Driving ● Open door car



[Prof. John Christianson](#)
(Neuro)

1. Tracking rat behaviors

- **Motivation:** we aim to use a machine learning approach to tracking the behavior of rats in our social choice tests.
- Project 1: image segmentation. More details here [\[link\]](#)



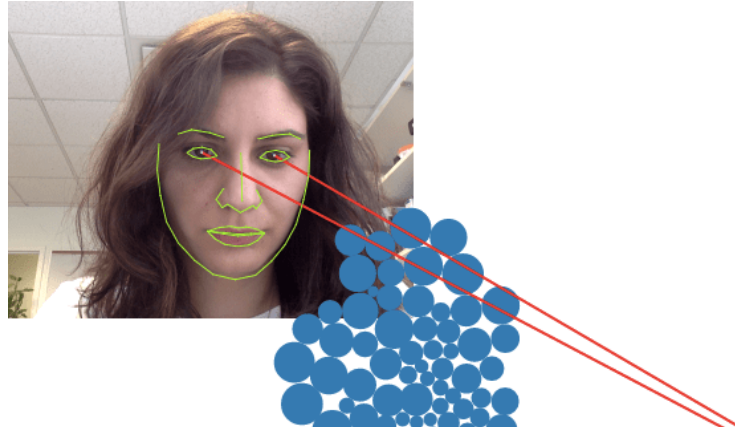
[Prof. Joshua Hartshorne](#)
(PSYC)

1. Robust webcam-based eye-tracking algorithm for psychological studies.

- **Motivation:** Reproducibility is a huge issue in psychological studies due to the small number of participants of the experiment. This issue was seriously discussed in a Science (2015) paper “Estimating the reproducibility of psychological science”, where Prof. Hartshorne was a co-author. One idea to build reproducible psychological studies is to improve the webcam-based eye-tracking tool, enabling crowd-sourcing the experiments to online users instead of participants coming to the lab.
- **Project 1:** Improve current method, [WebGazer.js](#)
- **Project 2:** build a online feedback tool that helps the participants adjust lighting/pose

2. Verb knowledge graph through video datasets.

- **Motivation:** You may all have heard the story how the ImageNet dataset revolutionized AI. ImageNet is modeled after the WordNet in Psychology. So, what about verbs, which are more complex and ambiguous to even define. Can we try sth. with the existing video datasets (1 million 3 sec videos with verb labels), [“Moments in Time” dataset](#), or other task-specific datasets, [EpicKitchen dataset](#).
- **Project 3:** re-examine the dataset from the psychology perspective.



Prof. Angie Johnston
(PSYC)

1. Dog anxiety prediction from cellphone videos
 - **Motivation:** Dog is known to be the best friend of men. Monitoring dogs' mental health, e.g., anxiety, is critical for its lifespan and its owner's life quality. Recently, there is a South Korean startup company selling \$99 collars to measure the emotion of dogs [\[link\]](#). Can we do it in a non-invasive fashion through phone cameras.



[Prof. Elizabeth Kensinger](#)
(PSYC)

1. Emotion knowledge graph through images:

- **Motivation:** How do we process and remember emotional experiences? Our research has demonstrated that the effects of emotion are not equal in all individuals; the effects of emotion can be influenced by individual differences in anxiety level or in cognitive control, or by the age of the person. We seek to understand the basis for these individual differences in emotional memory.
- **Project 1:** build an EmotionNet for a data-driven knowledge graph for the emotion space. Current CV methods aim to recognize the emotion from human facial expressions. Our task is different, trying to model what in the world arouses people with different background of different emotions



