How to Choose a Project for CS336
Perception + Controls

- Only perception: image segmentation
- Only controls: ground truth object states
- Perception + controls: informing your control strategy with some raw sensor data
Picking a topic

• What kind of problem?
  • Navigation, manipulation, games, etc.

• What dataset or simulator?

• Main focus: controls, perception, both?

• What general method?
  • RL, optimal control, MPCs, state estimation
Manipulation Simulators

• Use the one you’re most familiar with!

  • Sai2 (CS327A)
  • MuJoCo (CS234)
  • PyBullet
  • RLBench ([https://github.com/stepjam/RLBench](https://github.com/stepjam/RLBench))
  • DART, DRAKE, Gazebo
MuJoCo

- Robosuite: https://github.com/StanfordVL/robosuite
- Meta-World: https://github.com/rlworkgroup/metaworld
Navigation

- Ai2Thor: http://ai2thor.allenai.org/
- Gibson: http://gibsonenv.stanford.edu/method/
- FB AI Habitat: https://aihabitat.org/
Simpler environments

- PyMunk (2d physics library)
- Double integrator arms
- Grid world
- Atari
Datasets

- SLAM Datasets: https://github.com/youngguncho/awesome-slam-datasets
- First-person hand action dataset: https://guiggh.github.io/publications/first-person-hands/
- JackRabbot Dataset and Benchmark: https://jrdb.stanford.edu/
- Kitti Visual Odometry: http://www.cvlibs.net/datasets/kitti/eval_odometry.php
- YCB Benchmark: http://www.ycbbenchmarks.com/
- Google dataset: https://sites.google.com/site/brainrobotdata/home
- DexNet: https://berkeleyautomation.github.io/dex-net/
Get inspiration!

- Top h5-index papers from each conference

<table>
<thead>
<tr>
<th>Rank</th>
<th>Publication</th>
<th>h5-index</th>
<th>h5-median</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IEEE International Conference on Robotics and Automation</td>
<td>82</td>
<td>113</td>
</tr>
<tr>
<td>2</td>
<td>IEEE/ASME Transactions on Mechatronics</td>
<td>84</td>
<td>80</td>
</tr>
<tr>
<td>3</td>
<td>The International Journal of Robotics Research</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>IEEE Transactions on Robotics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>IEEE/RSJ International Conference on Intelligent Robots and Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Robotics and Autonomous Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Robotics: Science and Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Journal of Intelligent &amp; Robotic Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Robotics and Computer-Integrated Manufacturing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Journal of Field Robotics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>ACM/IEEE International Conference on Human Robot Interaction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Autonomous Robots</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Top publications**

<table>
<thead>
<tr>
<th>Title / Author</th>
<th>Cited by</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>SVC: Fast semi-direct monocular visual odometry</em></td>
<td>921</td>
<td>2014</td>
</tr>
<tr>
<td>C. Forster, M. Pourre, D. S. S. F. C.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014 IEEE International Conference on Robotics and Automation (ICRA), 15-22</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Supersizing self-supervision: Learning to grasp from 50k tries and 700 robot hours</em></td>
<td>366</td>
<td>2016</td>
</tr>
<tr>
<td>L. Finta, A. Gupta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016 IEEE International Conference on Robotics and Automation (ICRA), 3408-3413</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Target-driven visual navigation in indoor scenes using deep reinforcement learning</em></td>
<td>380</td>
<td>2017</td>
</tr>
<tr>
<td>Y. Zhu, R. Mattaghi, E. Kolve, J. Lim, A. Gupta, L. F. Fai, A. Farhad</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017 IEEE International Conference on Robotics and Automation (ICRA), 3387-3364</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>A benchmark for RGB-D visual odometry, 3D reconstruction and SLAM</em></td>
<td>380</td>
<td>2014</td>
</tr>
<tr>
<td>A. Honcic, T. Wheeler, J. McDonald, A. Day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014 IEEE International Conference on Robotics and Automation (ICRA), 1524-1531</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Deep reinforcement learning for robotic manipulation with asynchronous off-policy updates</em></td>
<td>311</td>
<td>2017</td>
</tr>
<tr>
<td>S. Gu, E. Holf, T. Lillkrop, S. Levine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017 IEEE International Conference on Robotics and Automation (ICRA), 3389-3396</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Get inspiration!

• Papers from seminar classes

• Advanced Survey of RL: http://cs332.stanford.edu/#!index.md

• Advanced Topics in Sequential Decision Making: http://web.stanford.edu/class/aa229/

• Topics in Advanced Robotic Manipulation: http://web.stanford.edu/class/cs326/

• Safe and Interactive Robotics: https://dorsa.fyi/cs333/
Get inspiration!

- Projects from DeepMind, FAIR, Brain often come with code and demos:
  - World Model: https://worldmodels.github.io/
Project Types

- Improve an existing approach.
- Case study: Apply an architecture/algorithm to a new problem.
- Join a research project
- Stress test existing approaches.
- Design your own approach.
- Mix and Match approaches.
How to read papers

• Look figures and captions first

• First pass order
  • Title, abstract
  • First few paragraphs of introductions
  • Conclusion
  • Methods
  • Results

• Don’t read it in one go (make several passes)
Resources for papers

- Blogs, medium, etc.
- Distill: https://distill.pub/about/
- 2 minute papers: https://www.youtube.com/channel/UCbfYPyITQ-7l4upoX8nvctg
- Online implementations of the code
  - Play around with the code
Come to Office Hours! :) 

- If you have a general topic, we can probably rattle off some papers for you to look into

- Jeannette and Roberto are great resources for narrowing in on research idea