mlPC Lab
Research Guide

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1. Welcome To mlPC Lab

mlPC Lab is offering research positions all year round to current UCSD students. We are looking for talented undergraduate and master students, who are excited about pushing the state of the art in machine learning. Our research is at the intersection of computer vision, nature language processing, machine learning, deep learning, reinforcement learning.

We are one of the fastest rising machine learning research lab with large impact at UCSD. As a student researcher, you will collaborate with our Ph.D. researchers and PI (Zhuowen Tu), and have a chance to publish your work in top academic conferences.

2. mlPC Lab Structure

We currently have 6 PhD Students with different specializations.

Most research projects within mlPC Lab will be done by

- (1) PI (Prof. Zhuowen Tu)
- (1-2) PhD student(s)
- (0-2) level 3 / level 4 Research Assistant(s)
- (0-2) level 1 / level 2 Research Assistant(s).

3. Admissions (I)

Currently, there is a large amount of requests to join our lab, and we are not be able to let everyone in due to limited resources. To clear up the requests, we give qualification exams on python programing and machine learning.

Some selected topics include:

- Math: Linear Algebra, Probability Theory, Information Theory
- Machine Learning: Machine Learning
- Deep Learning: NNs, CNNs, RNNs, Generative Models
- Reinforcement Learning: Value-based methods, Policy-based methods, Actor-Critic methods
- We currently use Python and TensorFlow as our programming language and deep learning frameworks exclusively.

3. Admissions (II)

If you are unfamiliar with some topics above, we encourage you to learn them based on the learning package we provide in **Section 7**. If you believe you have already had a strong background, you can contact yix081@ucsd.edu to take the qualification exam directly.

(All positions will be granted on a rolling basis. We encourage sophomore/junior talented undergraduate students who have learnt the listed material to apply for our research positions.)

4 Policies (I)

- Please report any conflict of interest or time before you are assigned to a project. Some common cases can be >4 courses within a quarter, TOEFL & GRE exams, duties in another lab and so forth.
- The duration of each research project is designed to be 1-2 quarter(s), and each project usually aims to submit to one of the top ML/CV/NLP conferences, such as ICLR, ACL, EMNLP, CVPR, ICCV and NIPS.
- The order of authors on a paper will be decided before paper submission by PI (Prof. Zhuowen Tu) based on each individual's contribution.

4 Policies (II)

- We usually hold a weekly lab meeting on Friday to discuss some advanced topics, and a weekly group meeting on Monday to discuss the current progress and to assign major weekly tasks.
- It is your responsibility to discuss and finish weekly tasks on time. Your weekly report and codes should be submitted to the group drive and repository before 11:00 PM on Sundays. A detailed explanation is in Section 8.
- If you are absent from a research project without permission or hold a negative attitude toward the research, you may be removed from the research.

5 Non-Disclosure Agreement

NDA is a legal agreement between at least two parties that outlines confidential materials or information that the parties wish to share with one another, but restrict access to or by third parties.

Once you join a research project in our lab, you must agree to the following terms:

- You are not allowed to share or discuss unpublished materials with individuals or parties outside your research group.
- You are not allowed to share unreleased project codes with individuals or parties outside your research group.

6 Available Research Positions (I)

Level 1 Research Assistant:

- An entry level research position.
- Your duties are mostly to support a variety of tasks within a lab, such as preparing data, and running experiments.

Level 2 Research Assistant:

- A more skilled research position.
- Your duty is to contribute to a part of a research project under instruction.

6 Available Research Positions (II)

Level 3 Research Assistant:

- A position for some specialized experiments.
- Your duty is to lead a part of a research project under PhD students / PI.

Level 4 Research Assistant:

- A position for some highly specialized experiments.
- Your duty is to do an independent research, or to lead a major part of a research project with / under PhD students / PI.

7 Training Program

In order to guide you to do a complete study before the qualification exam, we have provided some helpful links below for you to study. There are many other equivalent online materials, and you may choose any of the them to study based on your preference. The selected topics include:

- Math: Linear Algebra, Probability Theory, Information Theory
- Machine Learning: basic Machine Learning knowledge
- Deep Learning: Deep learning, Deep Learning in CV, Deep Learning in NLP
- Reinforcement Learning: Value-based methods, Policy-based methods, Actor-Critic methods
- TensorFlow: Develop Guide, Examples,

8 Weekly Progress Report (I)

Most projects are done by multiple researchers within the lab. In order to work smoothly without miscommunication, we will adopt the following policies to perform a research study:

Monday:

- A group meeting will be held every Monday to discuss the current progress, and to assign major tasks.
- A task description should be written once any task is assigned to you.
- It is your responsibility to re-confirmed your task with the Team Lead based on the task description you have written before proceeding.

8 Weekly Progress Report (II)

Monday - Sunday (Before 11 PM):

- A task report should be finalized together by every research group before Sunday 11 PM every week. This report should be submitted to the PhD student(s) / PI in charge of the project.
- Project repositories and logs/results/models should be uploaded to Drive together with the weekly report. Everything should be clear and clean. Please check details in Section 9 to meet the requirements.
- Notice 11PM is a hard deadline. Even if a task cannot be finished by Sunday 11 PM, you should still finalize your part of the report, and be prepared to discuss the issues you have with the team lead on Monday.

9 Project Maintenance (I)

Although we always ask you to do it fast, it is also important for you to do it right. Specially, most projects are done by multiple researchers; your mistakes may influence the progress of other team members.

Projects are usually recycled multiple times. It is always good to consider that your codes may be used in a later project. Once a paper gets published, many other top researchers will also come to get our implementation. Keep a nice project structure will benefit the community.

9 Project Maintenance (II)

Code Maintenance:

- Write a proper amount of comments. Not too few; not too many.
- Declare your variables and functions in a reasonable way.
- You should always clean the code before submission.
    - Remove unnecessary code.
    - Remove unnecessary comments.

9 Project Maintenance (III)

Project Maintenance:

- Each project contains
  - folders of each version
  - a folder of weekly progress reports
  - a readme explaining each version
- Each folder contains
  - a code repository containing codes, logs, models, which can be used to reproduce results
  - a docs folder containing all the finalized results which can be used in papers
  - a readme explaining functionality.

10 Debugging

Good debugging skills is very important for the project. However, no one is good at debugging. The best way to debug is to not create bug in the first place.

The most common reasons for a bug or a mistake to occur are:

- Writing codes without clear plans and checking procedures
- Misunderstanding the provided codes or tasks
- Misusing library functions.

10 Debugging

Procedures to follow after you observe problems in submitted materials:

- Locate the mistaken part(s) within the code following the code proceeding order
- If you know the expected behavior of the codes,
    - check if you use functions correctly
    - check if your variables are declared right
    - check online solutions, and official documentations
    - communicate with your team lead immediately
- If you don't know the expected behavior of the codes
    - review the task you are solving, and rethink if your procedures is correct
    - communicate with your team lead immediately