李宏毅 (Hung-yi Lee) · HYLEE | Machine Learning (2021)

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Homework 15
Meta Learning

ML TAs 陳建成（Chien-Cheng Chen）
黃冠博（Kuan-Po Huang）
ntu-ml-2021spring-ta@googlegroups.com

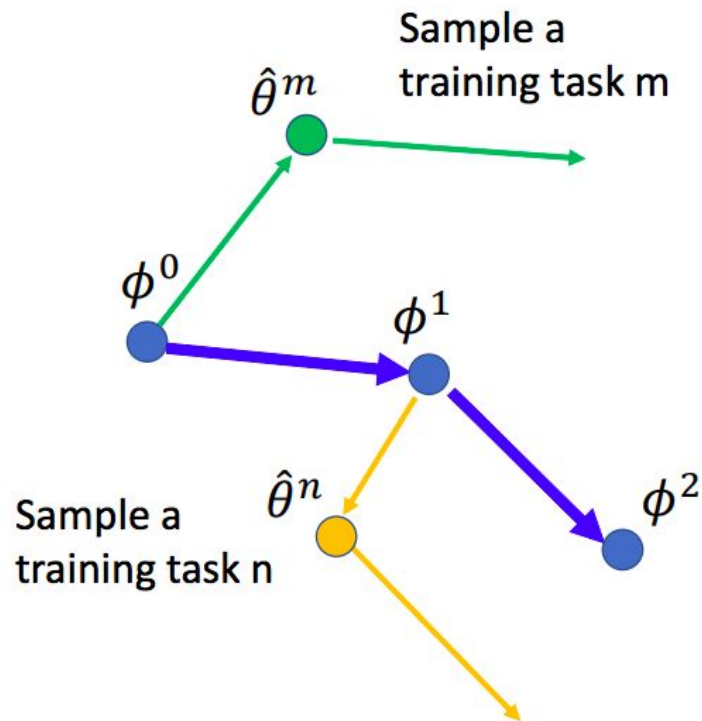# HW15 - Meta Learning - Few-shot image classification

Training MAML on Omniglot classification task.

Testing set
(Query set)

Training set
(Support set)

Sample a
training task m

$\hat{\theta}^m$

ϕ^0

ϕ^1

ϕ^2

Sample a
training task n

$\hat{\theta}^n$

Steps to finish this homework

1. Realize basic concepts of meta learning
2. Run and observe the codes of MAML for Omniglot few-shot classification
3. Realize variants of MAML, including FOMAML and ANIL algorithms
4. Try to fill in the codes to finish the algorithms mentioned above
5. Read some related papers to know more about meta learning
6. Finish questions of multiple choice on NTU COOL

Omniglot Data Format

`omniglot.tar.gz`

You will obtain two folders after decompression:
`images_background` (training tasks) and `images_evaluation` (test tasks)

There are many texts of different languages in each folder. For instance, say `Crillic.180`, "`180`" is the rotation angle. We have many distinct characters in each language, 20 `png` files for each character. For example,

`Omniglot/images_background/Cyrillic.180/character01/0218_06.png`

Principles

Please refer to lecture [slides](#)

$$\nabla_{\phi} l(\hat{\theta}) = \begin{bmatrix} \partial l(\hat{\theta})/\partial \phi_1 \\ \partial l(\hat{\theta})/\partial \phi_2 \\ \vdots \\ \partial l(\hat{\theta})/\partial \phi_i \\ \vdots \end{bmatrix} = \begin{bmatrix} \partial l(\hat{\theta})/\partial \hat{\theta}_1 \\ \partial l(\hat{\theta})/\partial \hat{\theta}_2 \\ \vdots \\ \partial l(\hat{\theta})/\partial \hat{\theta}_i \\ \vdots \end{bmatrix} = \nabla_{\hat{\theta}} l(\hat{\theta})$$

(FOMAML)

https://www.youtube.com/watch?v=mxqzGwP_Qys&list=PLJV_el3uVTsOK_ZK5L0Iv_EQoL1JefRL4&index=38

Important hints:

1. Original MAML: [slides](#) p.12 - p.18 & p. 21 - p. 26
2. First-order approximation MAML (FOMAML): [slides](#) p. 24 - 27
3. MAML tips: [How to train your MAML?](#)
4. ANIL: Feature reuse

Related Applications about Meta Learning

- Speech separation
  - Solving the cocktail problem
- Speech recognition
  - Help low-resource and speaker adaptation scenario
- Neural Machine Translation
  - Help low-resource languages

Links

- Code: [Colab]
- Questions: [NTU COOL]

Grading

25 multiple choice questions

- Basic concepts: 6 questions
- Implementation: 11 questions
- Advanced Tips: 5 questions
- Application: 3 questions

You have to choose ALL the correct answers for each question.

Submission

- No late submissions allowed !
- If there are submission problems or issues about NTU COOL, you should notice the TAs **before** the deadline.
- Start the homework earlier, so that your submission will be on time.
- NTU COOL forces a submission if you are still working on the homework at the point of the deadline. Things become complicated if this case happens.
- **Deadline: 2021/7/9 23:59**

Regulation

- **No cheating allowed !!!**
- Cheating includes but not limited to:
    - Any form of asking other people the answers.
    - Any form of giving out any answer of the questions.
    - Exploiting NTU COOL.
    - Sharing NTU COOL accounts.
    - Doing homework for others.
- Feel free to notify the TAs if you discover any form of cheating.
- Cheating leads to serious consequences, including a deduction of your final grade, zero credit for this homework or even get an F.

Reminder

- Please *don't change the original code*, unless the question asks you to do so.
- If there is any confusion, send an email to the TAs with the subject "[Hw15] …"
  - Please follow the naming rule !
  - Please do not send direct messages to the TA or to TA's personal mailbox. (Your mail will *probably be ignored* if you do not follow the rules above.)
- Do not ask questions without any effort of your own.

If any questions, you can ask us via...

- NTU COOL (recommended)
  - https://cool.ntu.edu.tw/courses/4793/discussion_topics/40345
- Email
  - ntu-ml-2021spring-ta@googlegroups.com
  - The title **must** begin with "[Hw15]"
- TA hours
  - Each Monday 19:00~21:00 Online (Google Meet)
  - Each Friday 13:30~14:20 (Before Class) Online (Google Meet)

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