AutoML Lecture

Summer Term 2021

Marius Lindauer, Frank Hutter, André Biedenkapp, Difan Deng

Leibniz University Hannover & Albert-Ludwigs-Universität Freiburg

Automated Machine Learning Hannover

Goals of the Lecture

You will be able to ...

1. use AutoML tools
2. develop AutoML tools
3. have a good overview over the state-of-the-art in AutoML
4. do research on AutoML yourself
   - perfect opportunity to do a master project or thesis with us afterwards

Course Overview

- Introduction
- Evaluation
- Algorithm Selection
- Hyperparameter Optimization
  1. Basics
  2. Gaussian Processes
  3. Bayesian Optimization
  4. Grey-Box Approaches
  5. multi-criteria optimization
- Neural architecture Search I + II
- Learning to learn and dynamic approaches
- Automated analysis

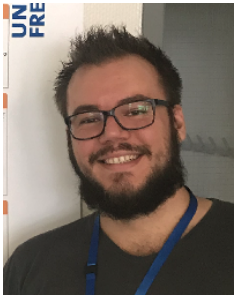
Course Format

- Concepts over details
  - we provide references and links to papers s.t. you can read up details!
- Interactive lecture
  - more efficient learning through self-reflection
  - (was already planned before the COVID-19 outbreak)
- Practical exercises
  - implement it, use it and play with it!

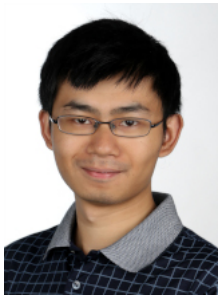
Team

Prof. Dr.
Marius Lindauer

Prof. Dr.
Frank Hutter



André Biedenkapp



Difan Deng

. . . more people were involved to prepare this lecture — see second video of first week.

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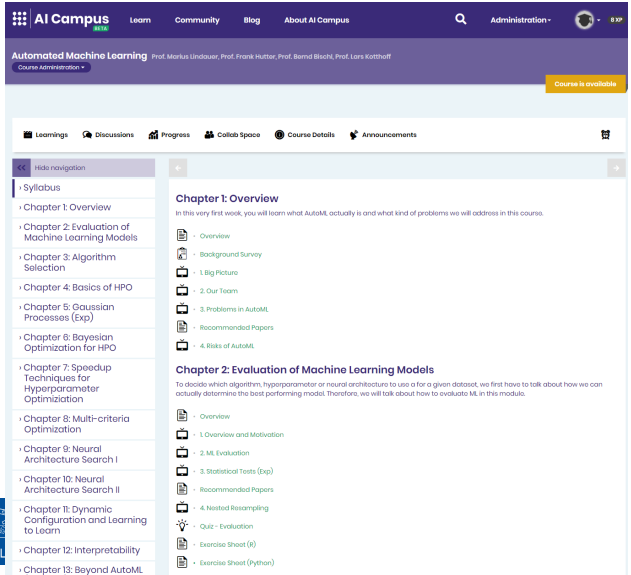

- Videos
  - Also watch the "expert" videos (exp)
  - We recommend to watch the "optional" videos, but you don't have to.
- Quiz
- Literature recommendations
- Exercise Sheets
- Track your own progress!

Why Videos?

- Advantages of videos:
  - Watch it whenever (wherever) you want
  - Watch it at your own speed
    - ⇝ Stop it if you need time to think about it
  - Go back and watch it again, if you missed or forgot something
  - Annotate questions on the fly (e.g., using the Miro boards)
  - after each video (∼10-20min), you can take a break and think about what you learned in this video (and whether you understood it)

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- Risks and challenges:
  - You have to be self-disciplined
  - You have to wait with your questions until our meetings
    - ⇝ Use our chat to discuss with your peers

Organization (Exercises)

- Every week new exercise sheet
  - Exercise focus is aligned with videos
  - Watch videos and start to directly work on exercise
  - ⇝ Deadline one day after the live session: Thursday at 23:59
- Most exercises will be practical, i.e., you have to implement something
- Team work highly recommended, team size at most 3!
- Build upon GitHub classroom ⇝ enables auto-grading
  - There will be an invitation link each week – distributed via Mattermost

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- Exercises are not mandatory
  BUT: quite unlikely that you will pass the lecture without doing them

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- For Hannover students: According to the module catalog, you have to be present in all in-class exercise sessions

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- Alternative proposal: You submit something for each exercise sheet.

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  4. Interactive quiz where you can check whether you understood the main points
- No recordings of the live sessions

Get in Touch with Us

- Live session every Wednesday (2pm s.t.)
- Mattermost Chat:
  - Use your real names
  - `https://im.tnt.uni-hannover.de/signup_user_complete/?id=s9na45demfnqxdga5g6i1zr39o`
  - First use the channel "2021 Summar AutoML Lecture"
  - Contact us individually only if these are personal questions (such as "I'm sick and have to cancel my exam")
- Don't use the forum in StudIP, ILIAS or the AI-Campus
- Don't send us emails
  - ⇝ Only in case of emergencies (and even in such cases it is better to use Mattermost)

Requirements for Attending

- Knowledge and hands-on exp. in Machine Learning (mandatory)
  - Classification, regression, clustering, decision tree, training-test split, cross validation, pre-processing ...
  - to catch up (if nec.): `https://www.coursera.org/learn/machine-learning`

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  - to catch up (if nec.): `https://course.fast.ai/`
- Experience in Python and git (strongly recommended)
  - nearly all exercises will require that you implement something in Python and submit the solution to a git repo

Final Oral Exam – Tentative Plan!

- Implement a larger project (worth $1-2$ weeks full time)
- Exam
  - Present the project in the first 15 minutes (including some questions from us)
  - Answer questions about further course material in the second 15 minutes
- Tentative date: September 20th - 24th

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- Tentative date: September 20th - 24th
- If the COVID-19 situation has not improved by then, we will offer virtual oral exams
  - $\rightsquigarrow$ webcam and stable internet connection required!

Additional Resources

- To get a deep understanding of AutoML,
  you should also read some papers
- We provide links to important papers after each video
- Recent AutoML book: `https://www.automl.org/book/`

Opportunities and Risks

AutoML is an advanced lecture and we update it each time.

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Opportunities:

- All presented topics (except some basics) are close to state-of-the-art; there is active research on these topics
- The course will provide a solid background for doing a master project/thesis in our group

Risks:

- You will find some typos and issues in the slides; please tell us if you find something
- Second time, fully virtual

Bonus Points (Only LUH!)

- GitHub repos:
  - Slides: `https://github.com/automl-edu/AutoMLLecture`
- If you find bugs in the slides or exercises,
  students from Hannover can obtain bonus points:
  - 1 point for every major bug in an equation
  - 0.5 point for every typo in the slides
  - 1 point for every code bug in the exercise
- At most 15 points ($\rightsquigarrow$ can close the gap between 1.7 and 1.0)
- Submit a PR to our repos and ensure that we can decipher your real name
- Students from Freiburg are also invited to submit PRs (but cannot obtain bonus points)

ToDos for Next Week

1. Watch the videos of the 2nd week
2. Work on the first exercise sheet (regarding evaluation of ML algorithms)

Questions?