Week 4: Thursday (Part 1) Project

- **How to write a great research paper (you can just read the slides if you prefer)**
- **Ten simple rules for structuring papers**

1. What are the three most important pieces of advice in the two papers? (3 total, not 6, since several ideas are repeated)

Ans: The paper must have one clear and sharp idea and we must be explicit with it and the reader should have no doubt about what the main idea is.

As we tell our story in the research paper, we need to describe it with molehills and not mountains and we must state our contributions first. They must be refutable and must drive the rest of the paper.

We must include related work in the end and not in the starting as it gets between the reader and our idea.

We do not have to make other people's work look bad in order to make our work look good and we must warmly acknowledge other people who helped us.

2. Pick one of the pieces of advice and give an example from one of the papers that we've read that does a good job of following it.

Ans: The YOLO paper really followed the first piece of advice and they clearly proposed their idea in a very clear and sharp manner. They had a very good abstract for readers to decide if their paper would be interesting for them or not and they gave a longer description in their introduction. They had one clear idea and they went about describing everything related to it in the rest of their paper.

3. Pick one of the pieces of advice and give an example from one of the papers that we've read that does a bad job of following it.

Ans: Even though in the context of the paper, it was not really a bad idea to include related work in the starting, the stable diffusion did not follow the third piece of advice of including related work in the end and included it in the starting instead.

4. The papers don't do a great job of suggesting how to pick a research question. How might you get started?

Ans: There are a few ways to get started. We can try to think of a domain which interests us at the moment and try to do a literature review in that field and see what has been done so far and try to look for ways in which we can contribute.

If we are not finding any domain that interests us, we can just google state of the art models that have been created in the past few years and the journey of the creators that includes why they created it, how long it took, etc. and see if we can improve it in any way or use it in a different domain.

Week 4 Thursday (Part 2) AutoML:

Look into one of the general cloud platforms (AWS or Azure), and look into a more specific-proposed AutoML provider (DataRobot). Focus *AutoML products* & *documentation*;

1. What model structures does AWS / Azure AutoML cover?

Ans: AWS's Sagemaker Autopilot automatically prepares data, selects algorithms, and optimizes models and covers a range of model structures, including linear learners, XGBoost, deep learning models, and more, depending on the nature of the problem

2. What hyperparameter and design choices does AWS / Azure AutoML cover?

Ans: Sagemaker Autopilot manages the selection of the algorithm and the optimization of hyperparameters automatically along with feature engineering and model evaluation. It also allows for some degree of user customization in terms of specifying objective metrics, exploring trade-offs between model accuracy and training time, etc.

3. What model / products does DataRobot provide? What are some featured industry / use cases covered?

Ans: DataRobot offers an enterprise AI platform that automates the model building process, covering a wide array of models including linear models, tree-based models, deep learning models, and ensemble models.

DataRobot's platform is applied across various industries for use cases such as credit risk modeling, fraud detection, demand forecasting, customer churn prediction, and health diagnostics, among others.

4. What are the differences between the AutoML service (model, hyperparameters, functionalities etc.) on AWS / Azure and DataRobot? For what kind of user / real-world tasks would one type be more useful than the other?

Ans: AWS or Azure AutoML services are deeply integrated into their cloud ecosystems, offering seamless integration with other cloud services like data storage, computing resources, etc. They are suitable for users already embedded within those ecosystems, looking for a streamlined workflow from data storage to model deployment.

DataRobot provides a more standalone, end-to-end AI platform with a strong focus on model management, deployment, and monitoring, making it attractive for enterprises seeking a comprehensive solution for deploying AI models at scale.

AWS or Azure may be more suitable for users looking for integration with cloud services and infrastructure, while DataRobot may appeal to those focusing on rapid deployment and management of AI models across various use cases and industries.

5. How do most people currently usually do hyperparameter selection for deep learning?

Ans: Most people currently use a combination of methods for hyperparameter selection including,

Manual tuning: This is based on experience and intuition.

Grid Search: Exhaustive search over a specified parameter space.

Random Search: Random exploration of the parameter space.

Bayesian Optimization: Uses a probabilistic model to guide the search for the best hyperparameters.

Automated Hyperparameter Tuning Services: Examples include AWS SageMaker Hyperparameter Optimization, Azure HyperDrive, or third-party libraries like Optuna.

6. If you were an employee in one of these companies, what additional features would you build to increase the power of AutoML?

Ans: If I were an employee in one of these companies, to enhance AutoML capabilities, I would suggest the following two among many ideas,

Explainability and Transparency Improvements: Enhanced tools for understanding model decisions, important features, and overall model behavior.

Advanced Feature Engineering Capabilities: Automated generation and selection of complex feature interactions and transformations.