24COP509: DeepSeek

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Schedule

- Research and Preparation (1 hour)
- Group Presentations (20 minutes per group)
- Final Wrap-up (5-10 minutes)

Study the paper on DeepSeek.

Group 1: Architecture and Pre-training

1. How does DeepSeek LLM's architecture distinguish itself from contemporary models such as LLaMA, particularly regarding its structural innovations?
2. Analyse the model's approach to vocabulary tokenisation, with specific focus on the implementation of Byte-level Byte-Pair Encoding (BBPE).
3. What advantages does the multi-step learning rate scheduler present over the conventional cosine scheduler? Consider the implications for continual training.
4. Examine the rationale behind expanding the 67B model's parameters in network depth rather than intermediate width of FFN layers.
5. Evaluate the significance of pre-tokenisation in preventing token merging across different character categories.

Group 2: Scaling Laws and Hyperparameters

1. Investigate the methodology for determining optimal batch size and learning rate across different model scales, considering the compute budget C.
2. Analyse the relationship between compute budget and model performance, particularly regarding the power law relationship.
3. How does data quality influence the optimal model/data scaling-up allocation strategy? Consider the implications for model training.
4. Compare and contrast DeepSeek's scaling behaviour with previous established scaling laws in the literature.
5. Examine the model's approach to maintaining performance whilst facilitating continual training through hyperparameter optimisation.

Group 3: Alignment and Fine-tuning

1. Analyse DeepSeek's implementation of supervised fine-tuning (SFT) and its distinctive characteristics.
2. Evaluate the role of Direct Preference Optimisation (DPO) in enhancing model performance and alignment.
3. How does the model achieve balance across diverse training data during the fine-tuning process?
4. Examine the strategies employed to mitigate overfitting during fine-tuning, particularly for the 67B model.
5. Assess the impact of the two-stage fine-tuning process on model performance and behaviour.

Group 4: Evaluation and Benchmarking

1. Compare DeepSeek's performance against LLaMA-2 across various benchmarks, with particular attention to code and mathematics tasks.
2. Analyse the metrics utilised for evaluating multilingual performance, especially in Chinese and English tasks.
3. How does the model perform in open-ended evaluations compared to GPT-3.5? Consider both qualitative and quantitative measures.
4. Examine the methodology employed for safety evaluation and its effectiveness.
5. Assess the model's performance on specialised tasks, particularly focusing on code completion and mathematical reasoning.