



Figure 3: A broader overview of LLMs, dividing LLMs into seven branches: 1. Pre-Training 2. Fine-Tuning 3. Efficient 4. Inference 5. Evaluation 6. Applications 7. Challenges

multi-modal LLMs, augmented LLMs, LLMs-powered agents, datasets, evaluation, etc.

We loosely follow the existing terminology to ensure a standardized outlook of this research direction. For instance, following [50], our survey discusses pre-trained LLMs with 10B parameters or more. We refer the readers interested in smaller pre-trained models to [51, 52, 53].

The organization of this paper is as follows. Section 2 discusses the background of LLMs. Section 3 focuses on LLMs overview, architectures, training pipelines and strategies, fine-tuning, and

utilization in different domains. Section 4 highlights the configuration and parameters that play a crucial role in the functioning of these models. Summary and discussions are presented in section 3.8. The LLM training and evaluation, datasets, and benchmarks are discussed in section 5, followed by challenges and future directions, and conclusion in sections 7 and 8, respectively.