


Chapter 11

The Fine-Tuning Journey of ChatGPT in Industry Applications: Domains From Generic to Specific

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ABSTRACT

The recent evolution of natural language processing (NLP) has introduced models like ChatGPT, capable of handling various language-related tasks. However, generic models like ChatGPT may lack accuracy in specialized fields such as healthcare or finance. Fine-tuning these models enables adaptation to specific industry domains, improving performance and relevance. This paper delves into the concept of fine-tuning ChatGPT for specialized domains, examining the technical challenges and solutions involved in the process. We also discuss real-world applications across healthcare, financial services, and education, highlighting the benefits and ethical considerations. The paper concludes with future trends in fine-tuning techniques for broader applicability.

1. INTRODUCTION

1.1. Overview of ChatGPT: A Brief Description of ChatGPT and its Capabilities

AI has evolved in recent years with the recent achievement of large-scale language models as a new era in natural language processing. Of these models, OpenAI's ChatGPT (Generative Pretrained Transformer) has recently received a lot of attention due to its capability of providing human like response to the inputs given by it. This model employs the transformer architecture, which was first proposed by Vaswani et al. in 2017 and has since become the foundation of many current best practices NLP models since it can manage sequences better than the practices like RNN and LSTM before it (Agrawal & Carpuat, 2020). Some of ChatGPT's skills include language translation, text summarization, question answering, and writing on general primarily based on a broad range of fields of interest. It consumes

DOI: 10.4018/979-8-3693-8332-2.ch011

a lot of data and has billions of parameters that allow it to have a conversation with users while taking into account the context. This model is particularly useful in its ability to process and synthesize contextually warrant and semantically meaningful text in numerous languages and is equally applicable to generic syntactic/semantic problems. It is general-purpose and has found applications in many fields including customer relationship management, content writing (Akasaki et al., 2024). Nevertheless, in very specific areas, ChatGPT has been known to express below-par performance, though it is perfect in general areas. While generating answers to sacred questions, the generic models fail to have specialized knowledge of the answer domain, thus providing nearly accurate, relevant, and safe answers in industries such as medical, banking, or legal. This is where a form of optimization referred to as fine-tuning – the practice of taking a pre-trained model and optimizing it more effectively for tasks in a specific domain.

1.2. Importance of Fine-Tuning ChatGPT for Domain-Specific Applications

Fine-tuning ChatGPT is essential for aligning the model with domain-specific challenges. In healthcare, professionals use specialized terminology, and general models may misinterpret or unethically respond to such queries. In finance, precise interpretation of legal changes, regulations, and financial instruments is vital—something a generic model might mishandle, leading to flawed analyses or projections (Ay et al., 2023). Fine-tuning allows ChatGPT to learn from industry-specific texts, enhancing its grasp of domain jargon and improving its practical relevance (Cetinic et al., 2018). This process reduces errors and increases reliability. For example, a fine-tuned model in law can accurately interpret statutes and cases, aligning its output with professional expectations (Chittka & Vasas, 2016).

1.3. Purpose of the Chapter: Exploring Fine-Tuning for Specialized Use Cases

This chapter outlines general fine-tuning techniques for ChatGPT, emphasizing domain-specific adaptation, technical challenges, and key advantages. It explores how fine-tuning enhances model accuracy and domain relevance, improving contextual understanding for specific industries (Da Vinha Ricieri et al., 2024). The process involves domain-specific data collection, preparation, and validation—crucial steps to ensure relevance and avoid unnecessary generality (Deng & Li, 2013). Fine-tuning entails adjusting model parameters to reflect industry-specific terminology and linguistic nuances, including tuning hyperparameters and evaluating model fluency, accuracy, and relevance. Given that ChatGPT is a multi-modal model trained on broad NLP tasks, fine-tuning tailors it to domain-specific language and regulatory frameworks. For instance, medical documents often rely on acronyms and specialized terms, requiring optimized handling through adjusted tokenization layers (Emami et al., 2022). Tokenization is key for converting input into a format interpretable by the model, and in domain-specific applications, further tuning may involve modifying attention layers to focus on critical elements in context.

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