First, let's discuss the executive summary. The RATP (retrieval augmented thought process) framework represents a pivotal step forward by seamlessly integrating external factual documents into interpretable thought processes for large language models. This novel methodology eliminated the need for extensive LLM training or fine-tuning that may result in overfitting or either due to less available data may lead to under fitting, making these powerful models more accessible across diverse applications.

By leveraging Monte Carlo Tree Search (MCTS),

***Monte Carlo Tree Search (MCTS) is basically a powerful algorithm used in decision-making processes, particularly in game-playing and optimization problems. It simulates a form of tree exploration where each node represents a possible state of the system or game, and the edges represent possible actions that can be taken from one state to another.***

* ***Selection: Starting from the root node, MCTS uses a selection strategy to choose which child node to explore next. This strategy balances between exploring new nodes (with uncertain outcomes) and exploiting known nodes (with potentially good outcomes).***
* ***Expansion: Once a node is selected for exploration, MCTS may expand this node by adding child nodes representing possible future states or actions. These new nodes are added dynamically as the search progresses.***
* ***Simulation (Rollout): MCTS conducts a simulated rollout from the newly expanded node to a terminal state, using a default policy to estimate the outcome of the game or system from that state. This simulation provides insights into potential future outcomes based on current choices.***
* ***Backpropagation: After the simulation, MCTS updates the statistics of the nodes along the path taken during the selection phase. This update involves propagating information such as visit counts, rewards, or win rates up the tree from the leaf node back to the root.***

***MCTS is especially effective in scenarios where the search space is too large to explore exhaustively, such as in complex games or AI assisted chatbots***

Retrieval augmented thought process dynamically constructs thought processes, optimizing knowledge retrieval and integration during question answering. Experimental validation on medical datasets like emrQA demonstrates remarkable performance improvements over baseline methods, showcasing enhanced accuracy and reduced answer hallucinations that we have issue in LLM that forgetting the context of old information and generating false information in RATP this thing is dealt with enhanced accuracy. The implications of RATP are far-reaching, particularly in domains like healthcare and finance, where LLMs can now be more effectively deployed.

For example:

* ***Imagine a healthcare AI system designed to assist doctors in diagnosing patients. To maintain patient confidentiality, the AI cannot directly access individual medical histories during training. However, when faced with a query about a patient's symptoms, the system needs a way to access relevant medical knowledge without compromising privacy.***
* ***Consider a virtual assistant helping users with banking inquiries. By incorporating external financial regulations and industry knowledge, the AI can provide personalized advice without directly accessing individual banking details.***

Now, let's turn to the background. The background of the RATP framework sheds light on the challenges faced by traditional LLM-based approaches in question answering, especially when incorporating external knowledge sources.

These approaches often struggle with contextual understanding, leading to inaccuracies or incomplete responses. RATP addresses this by introducing a structured thought process that integrates factual documents, enabling more accurate and interpretable answers. By leveraging Monte Carlo Tree Search (MCTS), RATP optimizes knowledge retrieval and integration, making LLMs more versatile and effective across various domains, including sensitive data applications like healthcare. RATP enhances LLMs' thought generation by treating it as a multi-step decision-making process that integrates external knowledge.

***A multistep decision-making process refers to a complex sequence of decisions that are interconnected and build upon each other to achieve a desired outcome. Unlike simple decision-making, which involves making a single choice or action in response to a situation, multistep decision-making requires a series of interconnected decisions to be made over time, with each decision influencing subsequent steps.***

This paper highlights the significance of RATP in advancing LLM capabilities for real-world question answering tasks.

Now Ahad will further dissect paper more detailed about experiment and methodology used….