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| **Inventory of supplemental materials** | | | |
| **File name** | **Specific content** | | **Corresponding parts in the manuscript** |
| Table S1 | The CEM-EKB containing 235 documents | The CEM knowledge framework with 7 second-tier and 40 third-tier subdomains | Section 3.1 (Fig. 2) |
| The CEM-EKB containing 235 documents | Section 3.1 (Fig. 2) |
| Experts for pre-assessing the CEM-EKB | Section 3.1 (Fig. 2) |
| Table S2 | The CEM-QA training dataset containing 10,100 questions | The 1,800 answers to 200 questions from 9 GLLMs on the early trial | Section 3.2 (Fig. 3) |
| The CEM-QA training dataset for prompt understanding | Section 3.2 (Fig. 3) |
| The CEM-QA training dataset for mathematical computation | Section 3.2 (Fig. 3) |
| Table S3 | The CEM-QA test dataset containing 5,050 questions | The CEM-QA test dataset containing 5,050 questions | Section 3.4 (Fig. 5) |
| Experts for formulating the 2,225 questions | Section 3.4 (Fig. 5) |
| Table S4 | The 126,250 answers to 5,050 questions from 9 LLMs before and after the CEM knowledge integration and fine-tuning | | Sections 4.1, 4.2, 4.3, and 4.4 |
| Video S1 | Video clip of running original GLLMs | | Section 3.3 |
| Video S2 | Video clip of running CEM knowledge-incorporated GLLMs | | Section 3.3 |
| Video S3 | Video clip of running CEM knowledge-incorporated fine-tuned GLLMs | | Section 3.3 |
| Video S4 | Video clip of running CEM-QA prototype | | Section 5.2 |
| CEM-EKB | Chroma-formatted vectorized CEM-EKB | | Section 3.1 |
| FAISS-formatted vectorized CEM-EKB | | Section 3.1 |
| Codes | Codes for running original GLLMs | Codes for original ERNIE-Bot 4.0 and ERNIE-Bot-turbo | Section 3.3 |
| Codes for original GPT-3.5-turbo and GPT-4 | Section 3.3 |
| Codes for original Qwen-7B-Chat and Qwen-14B-Chat | Section 3.3 |
| Codes for original Baichuan2-7B-Chat and Baichuan2-13B-Chat | Section 3.3 |
| Codes for original ChatGLM3-6B | Section 3.3 |
| Codes for running CEM knowledge-incorporated GLLMs | Codes for CEM knowledge-incorporated ERNIE-Bot 4.0 and ERNIE-Bot-turbo | Section 3.3 |
| Codes for CEM knowledge-incorporated GPT-3.5-turbo and GPT-4 | Section 3.3 |
| Codes for CEM knowledge-incorporated Qwen-7B-Chat and Qwen-14B-Chat | Section 3.3 |
| Codes for CEM knowledge-incorporated Baichuan2-7B-Chat and Baichuan2-13B-Chat | Section 3.3 |
| Codes for CEM knowledge-incorporated ChatGLM3-6B | Section 3.3 |
| Codes for running CEM knowledge-incorporated fine-tuned GLLMs | Codes for CEM knowledge-incorporated fine-tuned ERNIE-Bot-turbo | Section 3.3 |
| Codes for CEM knowledge-incorporated fine-tuned GPT-3.5-turbo | Section 3.3 |
| Codes for CEM knowledge-incorporated fine-tuned Qwen-7B-Chat and Qwen-14B-Chat | Section 3.3 |
| Codes for CEM knowledge-incorporated fine-tuned Baichuan2-7B-Chat and Baichuan2-13B-Chat | Section 3.3 |
| Codes for CEM knowledge-incorporated fine-tuned ChatGLM3-6B | Section 3.3 |
| Codes for deploying and running the CEM-QA prototype | | Section 5.2 |

Due to too many materials, all supplemental materials are provided in the GitHub repository (<https://github.com/0AnonymousSite0/QA_for_CEM>). Besides the GitHub repository, the CEM-QA test dataset is shared in the Hugging Face repository ([https://huggingface.co/datasets/AnonymousSite/QA\_test\_dataset\_for\_CEM](https://huggingface.co/datasets/AnonymousSite/QA_test_dataset_for_CEM%20)).