**Solution Design Overview**

## Objective:

Develop a cloud-based function to process an array of OCR(Optical Character Recognition)-extracted text documents (all related to the same matter), and provide a high-quality summarized response with useful metadata.

## Steps

* **Data Cleaning and Organisation**: Filter and structure the OCR data for further processing.
* **Data Processing with LLM**: Send the organised data to an LLM (like OpenAI) for summarisation and metadata extraction.
* **Chunking Approach for Summarisation:** Implement a chunking strategy to abide by the maximal input token constraints of GPT-4.
* **Standardisation of Response**: Ensure the LLM's response is structured and consistent.
* **Response Aggregation**: Combine the LLM outputs into a unified, meaningful response.

## Proposed Solution

Technology Stack

* **Language**: Python (due to its strong support for data manipulation and integration with cloud services and AI/ML tools).
* **LLM Service**: OpenAI's GPT4 (known for its advanced text summarisation and analysis capabilities).
* **Cloud Provider**: GCP (Google Cloud Platform).

Architecture

* **Cloud Function**: A serverless function (Google Cloud Functions) to handle requests and orchestrate the workflow.

Workflow

* **Data Cleaning and Organisation**
  + Validate and clean the incoming data array.
  + Organise the text for efficient processing (e.g., concatenate texts, remove duplicates).
* **Data Processing with LLM**
  + Use an API call to send data to OpenAI.
  + Extract summaries and metadata with two distinctive types of prompts:
    1. Document Summary Prompt: Summarize individual documents focusing on the factual recount and the most salient points.
    2. Overall Summary Prompt: Once individual summaries are generated, use another prompt to synthesize these summaries into a comprehensive overview, emphasizing key legal insights and drawing connections between the documents.
* **Chunking Approach for Summarisation**
* Segment the organised text into chunks that conform to GPT-4's maximal input token limit.
* Summarize each document chunk individually to obtain partial summaries.
* Use the Overall Summary Prompt to synthesize these individual summaries into a coherent and concise overall summary that captures the essence and legal implications of the entire matter.
* **Standardisation of Response**
  + Format the LLM response into a standardised schema.
* **Response Aggregation**
  + Compile the summarised texts and metadata into a final response.

## Considerations

Scalability

* **Serverless Architecture**: Automatically scales with the number of requests.
* **Batch Processing**: For large data sets, implement batch processing to avoid timeouts and manage resource usage. (especially for processing large data sets of data that do not require real-time processing).

Security

* **Data Encryption**: Ensure all data in transit and at rest is encrypted. (AES -Advanced Encryption Standard, SSL-Secure Socket Layer/TLS – Transport Layer Security, Cloud Service Provider Tools, VPN,Cloud Storage Client-Side/Server-Side Encryption).
* **Access Control**: Implement strict access controls and authentication for the API. (Identity and Access Management (IAM), Authentication, Network Security – Virtual Private Cloud (VPC), API Gateway, Logging and Monitoring, Zero Trust Model.

Efficiency

* **Parallel Processing**: Where possible, parallelise the LLM requests for faster processing.
* **Caching**: Cache frequently accessed data to reduce processing time.
* Alternative Summarization Strategies: Reinforcement Learning, Semantic Representation

Pros and Cons

* **Pros**: Scalable, cost-effective (pay-as-you-go pricing model), leveraging advanced LLM capabilities, minimal maintenance.
* **Cons**: Dependency on external LLM service, potential latency issues, requires careful handling of data security.

Scoped Out Work

* Data Store: A cloud-based storage service for intermediate data handling (Cloud Storage).
* API Gateway: To manage and secure API requests to the cloud function.
* Advanced Security : Advanced Network Security(VPC), Authentication, Encryption, etc.
* Advanced NLP features for deeper analysis (due to time constraints).
* Custom ML model deployment (relying on existing LLM capabilities instead).

Deployment

* Use cloud provider's CI/CD tools for deployment.
* Ensure logging and monitoring are in place for troubleshooting and performance analysis.

## Next Steps

* Prototype development.
* Integrate the chunking approach into the prototype.
* Testing with sample data.
* Iterative improvements based on feedback.

This proposed solution aims to balance efficiency, scalability, and security, leveraging the strengths of cloud computing and LLM capabilities.