Video Stream Processing with Apache Storm

Distributed Systems Course

December 6, 2023

Objective

Develop a stream processing application using Apache Storm to perform real-time image processing on video files. The application will demonstrate distributed computing principles by processing video frames in parallel, applying image filters, and aggregating the results.

Framework and Tools

- **Primary Framework:** Apache Storm
- **Programming Language:** Java (recommended) or any other suitable language
- **Additional Libraries:** Image processing libraries (e.g., OpenCV for Java)

Functional Requirements

1. **Video File Reading:** Implement a mechanism to read video files. Extract individual frames from the video.
2. **Frame Analysis:** Count the total number of frames in the video. Calculate and record the average brightness of each frame.
3. **Image Processing Operations:** Convert frames to grayscale. Resize frames to a predetermined smaller size.
4. **Distributed Image Filtering:** Use Apache Storm's distributed processing capabilities. Create two types of processing elements (PEs): PE1 applies a Gaussian blur filter and PE2 applies a sharpening filter to the frame.
5. **Frame Aggregation:** Develop a PE that combines the output of PE1 and PE2. Sum up the matrices resulting from the applied filters.
6. **Output Creation:** Generate a new video file with the filtered frames. Produce a text file containing frame analysis data (average brightness, frame count).

Development Guidelines

- **Apache Storm Utilization:** Leverage Storm's topology to manage the distributed processing tasks. Ensure efficient data streaming and processing among the PEs.
- **Code Efficiency and Scalability:** Write clean, maintainable, and well-documented code. Design the application to be scalable for different video sizes.
- **Performance Optimization:** Optimize for minimal processing latency.

Deliverables

1. **Source Code:** Complete source code of the application with detailed comments.
2. **Documentation:** A comprehensive PDF report explaining the system design and architecture, description of the implementation process, and challenges encountered with solutions applied.
3. **Demonstration Video:** A screen recording demonstrating the application in action.

Note: Submissions missing any of the deliverables will result in **zero**.

Deadline

Submission Date: 22nd December, 23:59.

Good Luck!