

# COP4520 Project Proposal: Enhancing Image Processing through Advanced Multithreading

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## Abstract:

This project focuses on enhancing image processing speeds by focusing on the transition from single-threaded to multithreaded algorithm implementations. In these implementations, we will be employing a range of multithreading techniques taught in this course. Concentrating on three fundamental image processing algorithms, we aim to substantially decrease processing times and boost computational efficiency. These changes will allow the algorithms to fully utilize today's multi-core architectures.

## Methodology and Algorithm Selection:

Our approach involves the application of sophisticated multithreading techniques across three image processing algorithms:

1. **Blur Algorithms (Gaussian, Box, Motion Blur):** We plan to employ many threads and divide images into grid sections. Each thread will concurrently process its assigned grid section, allowing simultaneous blurring operations across different parts of the image. Some of these grid sections will require overlap, increasing the implementation complexity.
2. **Bucket Fill Technique:** We will implement a concurrent recursive approach where multiple threads will branch off onto sections of the image. This will involve coordinating threads to avoid conflicts and ensure efficient filling of large areas.
3. **Optimized Image Resizing (Bilinear, Bicubic, Nearest Neighbor):** Here, we'll divide the image into horizontal or vertical strips, assigning each strip to a different thread. This approach will enable concurrent resizing operations, reducing overall processing time.

## Expected Outcomes:

This project expects to yield:

- Substantial reductions in processing times for each algorithm using multithreading compared to single-threaded implementations.
- A detailed performance comparison between implementation and threading techniques
- Valuable insights into the scalability and effectiveness of multithreading in the three image processing tasks (e.g. 1 vs 2 vs 4 vs ... cores)
- A comprehensive report on the methodologies, experiments, and results of employing multithreaded techniques in image processing.
- Valuable applications of course materials for project group members.