RESEARCH PROPOSAL

Image Resizing by seam carving

Group name: Group 8

List of members:

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Keywords:

- Image resizing
- Content-awareness
- Seam-Carving
- Image Seam Removal
- Intelligent Image Cropping

List of references:

- Image resizing using Seam carving using OpenCV in Python - GeeksforGeeks
- imret.pdf (cmu.edu)
- Seam Carving Algorithm: A Seemingly impossible Way to Resize an Image (analyticsvidhya.com)
- seam-carving · PyPI
- GitHub - andrewdcampbell/seam-carving: A fast Python implementation of Seam Carving for Content-Aware Image Resizing.
- Seam carving with OpenCV, Python, and scikit-image - PyImageSearch
- Implementing Seam Carving with Python | Karthik Karanth

1. **Summary:**

Seam carving project aims to develop an image resizing technique while preserving important content of an image. The primary focus is to understand the concept of energy maps to identify and remove low-energy seams on an image (vertically or horizontally); therefore, it can reduce its dimensions without significantly impacting the exquisite quality of an image. To efficiently process a large resolution of an image and optimize performance, the project will leverage parallel systems like CUDA to speed up the processing. The parallel system will enable the implementation of parallel algorithms to simultaneously identify and remove low-energy seams, speeding up the process and improving overall efficiency.

2. **The challenge**

One key challenge is the sequential natural of the algorithm. Seam Carving relies on dynamic programming techniques, where each step depends on the previous result. This problem will make parallel become challenging to execute. Another challenge is the energy computation for each pixel involves examining the neighboring pixels. One other aspect is the irregular nature of seam removal, as the seams can have varying lengths and directions based on the image content, making load balancing and efficient parallel task distribution complex.

By working on this project, one can gain valuable insights into optimizing parallel algorithms for irregular and data-dependent computations. It provides an opportunity to explore techniques for efficient task scheduling and data dependencies management in a parallel environment. The project aims to find strategies to overcome the challenges of parallelizing seam carving, allowing for faster and more efficient image resizing. Additionally, this project can contribute to the broader understanding of parallel programming and optimization techniques for irregular and dynamic programming-based algorithms, which can be applicable in various domains involving similar computational challenges.

3. Resources

Microsoft Window operational system along with GPU will be our most priority, Google Colab is an alternative choice for implementing Seam carving for free. We hope to implement by hand the traditional ways and optimize the code with parallel processing and refer the algorithm listed at the end of the report. There are more than enough resources about the project available on the internet, so sort out valuable, informative paper, sources is important to avoid falling off the track.

4. Goals And Deliverables

- The expected goal of the team is to successfully complete the first 4 versions of the algorithm according to the team's plan.
- The desired goal of 125% is to not only complete all 4 versions but also apply the size reduction algorithm to real-time video processing.
- The 75% goal, in case of setbacks, is to only complete 2 or 3 versions according to the initial plan.
- For the presentation, the team will present algorithm ideas for each improved version. They will demonstrate the results through

images/videos before and after processing and display the runtime of each algorithm version for comparison.

Weekly schedule:

	Trần Xuân Phước	**Nguyễn Trung Hiếu**	**Lê Nguyễn Minh Tâm**
Week 01 (05/06 - 11/06)	- Select topic, search source - Algorithm research		
Week 02 (12/06 - 18/06)	- Learn and research about the Numba library in Python		
Week 03 (19/06 - 25/06)	- Generating ideas for running the sequential algorithm, parallel versions for Seam Carving. - Task assignment		
Week 04 (26/06 - 02/07)	- Code for the sequential algorithm (Sequences V1)	- Checking the correctness of the algorithm V1. - Finding ways to optimize algorithm V1. - Writing a report.	
Week 05 (03/07 - 09/07)	- Checking and finding ways to optimize algorithm V2. - Updating algorithm V1 (If applicable).	- Testing and finding optimizations for algorithm V2. - Updating the report.	- Code for parallel algorithm using CPU (Parallel V2)
Week 06 (10/07 - 16/07)	- Testing and finding ways to optimize algorithm V3. - Updating the report.	- Code for parallel algorithm using GPU (Parallel V3)	- Testing and optimizing algorithm V3. - Updating algorithm V2 (if applicable).
Week 07	…	…	...