Your Title Goes Here
Assignment #X, CSC 746, Fall 2022

Your Name Here*
SFSU

Ed Grimley†
Grimley Widgets, Inc.

Martha Stewart‡
Martha Stewart Enterprises
Microsoft Research

Abstract

The abstract should describe the basic message of the paper, including: the problem, why your solution should be of interest, some notion that your solution is effective, and a teaser about how it has been evaluated. Cover all of this using between 75 and 150 words. Thus, the abstract is the hardest part to write. Sometimes I try to write it first, but the final version is usually composed of items drawn from the introduction, and then condensed, as the last step of writing the paper.

1 Introduction

The problem we have solved

- Concentrate on making this assertion and only this assertion in a succinct set of 1 to 3 paragraphs
- A common mistake is to explain too much of the problem context first. Instead, state the problem essentially as a claim, and leave explanations supporting your claim to the next part, "Why it is not already solved."

Why the problem is not already solved or other solutions are ineffective in one or more important ways

- Your new idea need not solve every problem but it should solve at least one that is not already solved
- This is the place to provide a succinct description of the problem context giving enough information to support the claim that a problem exists, made in the preceding problem declaration.

Why our solution is worth considering and why is it effective in some way that others are not

- A succinct statement of why the reader should care enough to read the rest of the paper.
- This should include a statement about the characteristics of your solution to the problem which 1) make it a solution, and 2) make it superior to other solutions to the same problem.

How the rest of the paper is structured

- The short statement below is often all you need, but you should change it when your paper has a different structure, or when more information is required to describe what a given section contains. If it isn't required then you don't want to say it here.

The rest of this paper first discusses related work in Section 2, and then describes our implementation in Section 3. Section 4 describes how we evaluated our system and presents the results. Section 5 presents our conclusions and describes future work.

*email:youremail@sfsu.edu
†e-mail:ed.grimley@aol.com
‡e-mail:martha.stewart@marthastewart.com

2 Related Work

Sample citation to keep Latex happy [1].

Other efforts that exist to solve this problem and why are they less effective than our method

- Resist the urge to point out only flaws in other work. Do your best to point out both the strengths and weaknesses to provide as well rounded a view of how your idea relates to other work as possible.
- In a social and political sense it is very smart as well as ethically superior to say good things, which are true, about other people's work. A major motivation for this is that editors and program committee members have to get a set of reviews for your paper. The easiest way for them to decide who should review it is to look at the set of references to related work (e.g., [1,2, 3]) to find people who are likely to be competent to review your paper. The people whose work you talk about are thus likely to be reading what you say about their work while deciding what to say about your work.
- Clear enough? Speak the truth, say what you have to say, but be generous to the efforts of others.

Other efforts that exist to solve related problems that are relevant, how are they relevant, and why are they less effective than our solution for this problem.

- Many times no one has solved your exact problem before, but others have solved closely related problems or problems with aspects that are strongly analogous to aspects of your problem.

Sometimes, you need to include some equations in your report. Here are some examples that may be useful.

We can write the *quantum state* encoded by a single qubit as

$$|\psi\rangle \in \{x : x \in \mathbb{C}^2, \|x\| = 1\} \tag{1}$$

so that it is a complex-valued vector in 2 dimensions with unit norm. The notation $|\psi\rangle$ is known as *Dirac notation* and is the standard notation for writing quantum states. (We will see later in this section how to visualize a 1-qubit quantum state using a Bloch sphere.) The quantum states

$$|0\rangle = \begin{pmatrix} 1 \\ 0 \end{pmatrix}, |1\rangle = \begin{pmatrix} 0 \\ 1 \end{pmatrix} \tag{2}$$

correspond to the classical bit states of 0 and 1. As the astute reader may have observed, these two states form a small subset of possible quantum states. Nevertheless, we still have a tractable method to describe quantum states for the purposes of computation.

This can be done by observing that the set $\{|0\rangle, |1\rangle\}$ forms a basis for $\mathbb{C}^2$, known as the *computational basis*, so that every quantum state $|\psi\rangle$ can be written as a linear combination of $|0\rangle$ and $|1\rangle$. More formally, we can write

$$|\psi\rangle = \alpha |0\rangle + \beta |1\rangle \tag{3}$$

where α and β are *amplitudes*, and $\{\alpha, \beta\} \in \mathbb{C}$. When both α and β are non-zero, a quantum state is said to be in a *superposition* of $|0\rangle$ and $|1\rangle$ [2]. In this way, we can make sense of the idea that a single qubit is a combination of a $|0\rangle$ and $|1\rangle$ simultaneously.

3 IMPLEMENTATION

What we (will do — did): Our Solution

- Another way to look at this section is as a paper, within a paper, describing your implementation. That viewpoint makes this the introduction to the subordinate paper, which should describe the overall structure of your implementation and how it is designed to address the problem effectively.
- Then, describe the structure of the rest of this section, and what each subsection describes.

How our solution (will — does) work

- This is the body of the subordinate paper describing your solution. It may be divided into several subsections as required by the nature of your implementation.
- The level of detail about how the solution works is determined by what is appropriate to the type of paper (conference, journal, technical report).
- This section can be fairly short for conference papers, fairly long for journal papers, or quite long in technical reports. It all depends on the purpose of the paper and the target audience.
- Proposals are necessarily a good deal more vague in this section since you have to convince someone you know enough to have a good chance of building a solution, but that you have not already done so.

```
float smoothPixel(Si, Sj, S, R, weights) {
    // compute the weight sum of pixels nearby
    // this code doesn't handle edge conditions
    // and assumes sum of weights[i,j] = 1.0
    float sum = 0.0;
    for (int j=0; j<R; j++)
        for (int i=0; i<R; i++)
           sum += weights[i,j]*S[Si+i,Sj+j]
    return sum; }
```

Listing 1: Stencil computation in 2D: performs sum of product of nearby pixels with weights.

4 EVALUATION

How we tested our solution

- Performance metrics
- Performance parameters
- Experimental design

How our solution performed, how its performance compared to that of other solutions mentioned in related work, and how these results show that our solution is effective

- Presentation and Interpretation
- Why, how, and to what degree our solution is better
- Why the reader should be impressed with our solution
- Comments
- Here is a cross reference to Table 1 and Fig. 1.

Context and limitations of our solution as required for summation

- What the results do and do not say

Problem Size (N)	Ideal runtime (sec)	Actual runtime (sec)
1	1	1
2	0.5	0.75
4	0.25	0.56
8	0.12	0.42
16	0.06	0.31

Table 1: Comparison of actual and ideal runtimes for different problem sizes. The actual runtime does not equal ideal runtime in this configuration.

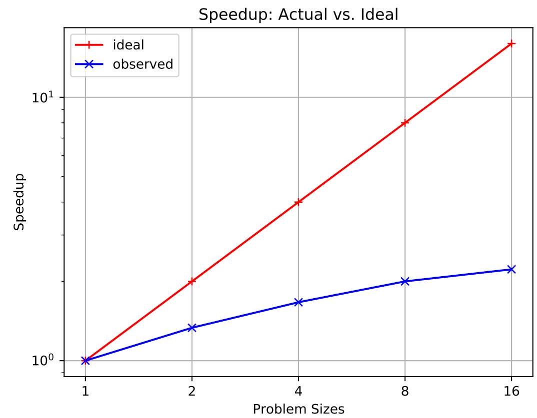

Figure 1: Comparison of actual vs. ideal speedup with increasing problem sizes. In this case, we see the observed speedup is quite different than the ideal speedup. Try changing the vertical axis to log-scaling in the Python script that generates the chart. This figure was produced by the sample `plot_speedup.py` file.

ACKNOWLEDGMENTS

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REFERENCES

[1] J. L. Hennessy and D. A. Patterson. *Computer Architecture, Fifth Edition: A Quantitative Approach*. Morgan Kaufmann Publishers Inc., San Francisco, CA, USA, 5th ed., 2011.

[2] M. A. Nielsen and I. L. Chuang. *Quantum Computation and Quantum Information: 10th Anniversary Edition*. Cambridge University Press, USA, 10th ed., 2011.