Image Deblurring
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2009-2010

Abstract

In the world of photography and machine vision, blurry images can spell disaster. They can ruin an otherwise perfect photo or make it impossible for a computer to recognize the image or certain components of it for processing. The best way to counter this without taking another, clearer picture is to utilize deconvolution techniques to remove as much blur as possible. My plan is to first design a program that takes an image, blurs it using a known blur kernel, then deblurs it to reproduce the original image. After that I will attempt to create a program to determine the blur kernel of a naturally blurred image.

Background

In my research I have found various methods of blind and non-blind image deconvolution. One paper discussed comparing a blurry, correct intensity image with a sharp, noisy image to produce a proper, deblurred output image with few artifacts. Another paper discussed an algorithm they developed to estimate the blur kernel and use that to deblur the image from just a single photograph. Various deconvolution algorithms already exist, and it is the other component, the blur kernel, that requires further research. The more accurately the blur kernel can be estimated, the more accurate and clear the output image will be.
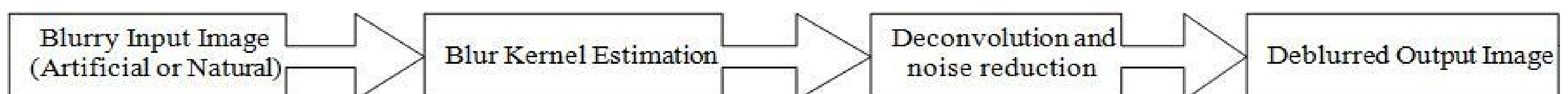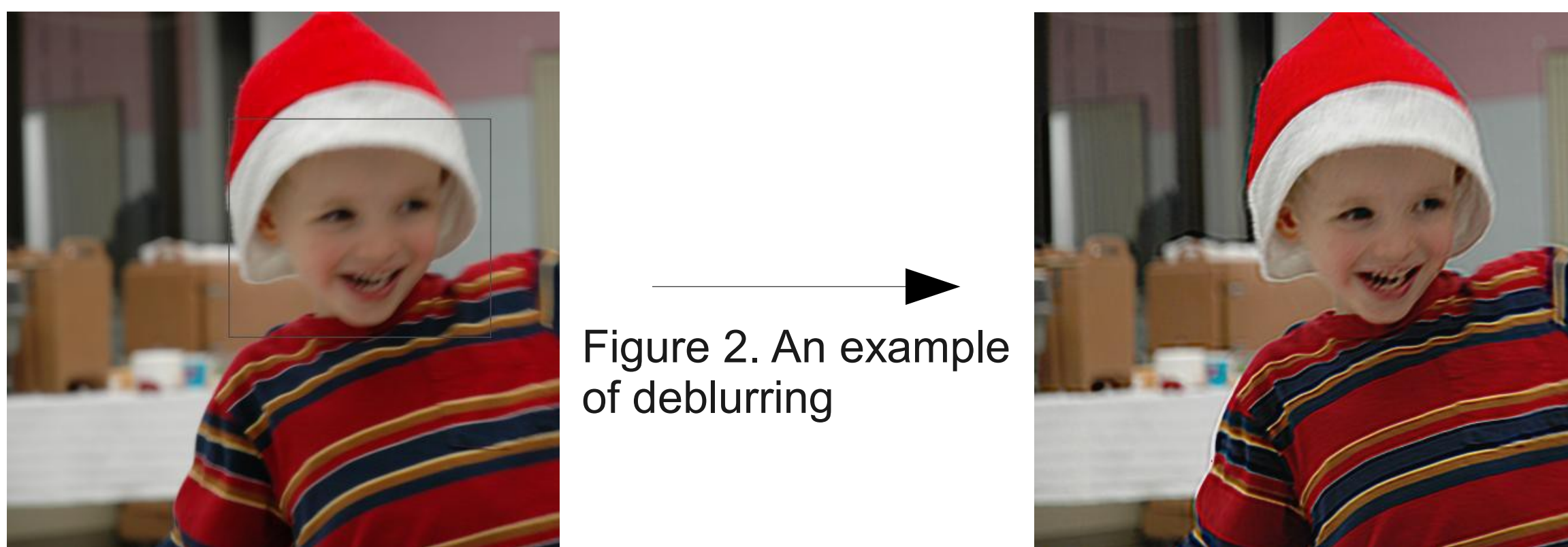
Blurry Input Image (Artificial or Natural) → Blur Kernel Estimation → Deconvolution and noise reduction → Deblurred Output Image

Figure 1. A graphical representation of the layout of my project design

Figure 2. An example of deblurring

Expected Results

From this project I expect to be able to obtain a completely, or almost completely, deblurred image from an image that has a moderate level of blur distortion. I hope that my program can perform these processes with a relatively high level of success, though I think that perfect deblurring of the image will probably be impossible, at least not without a higher level of understanding of complex concepts that I do not think I will be able to touch on within my limited time frame. Due to this there will likely be some artifacts in the output image, or leftover blur distortion that could not effectively be removed.