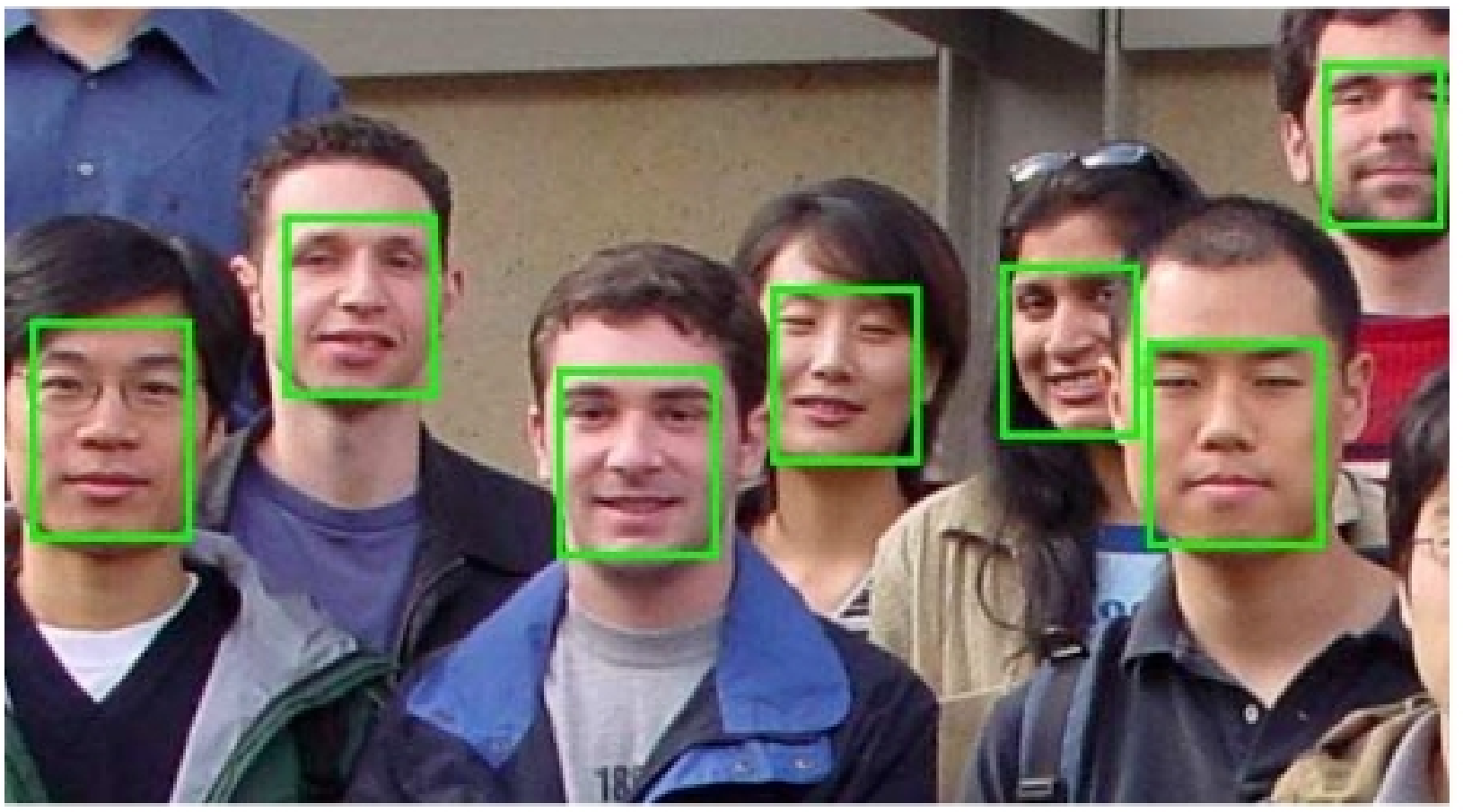

Face Detection on Similar Color Photographs

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EE368: Digital Image Processing
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1.0 Introduction

The basic skill of detecting faces in an image is something that humans often take for granted. Creating a computer program to perform the same task turns out to be a difficult problem for which more effective and more efficient algorithms continue to surface. In this project, the author attempts to combine some of these algorithms with the basics that were learned in EE368 to create a face detection algorithm for a specific set of images.

Seven images were provided as a way of developing and testing the class' algorithms. Each of these images had many similarities to each other and presumably to the final test image. The images were full color photographs of the Spring EE368 class of 2003. All of the pictures were taken in the same location, but with different arrangements of the students and professors. By taking advantage of these similarities, an effective algorithm has been developed that will hopefully be successful when performed on the final test image.

2.0 Face Detection Mechanism

The basic form of this algorithm follows a process that was very common among former EE368 students. The following two steps are performed:

1 – Skin Detection – Since the training set and the final image are all full color images, the separation of skin pixels from non-skin pixels can be accomplished quite effectively.

2 – Template Matching – By running only the skin pixels through a template matching algorithm, the faces can be separated from other visible skin such as arms or legs.

Using these techniques, the faces in the training images were recognized quite effectively. Although better approaches exist for more general circumstances, this approach works well for this particular situation.

2.1 Skin Detection

To accomplish the task of separating skin pixels from non-skin pixels, a concept was borrowed from digital communications. The Maximum Apriori Probability (MAP) detector in digital communications is based on Bayes' Rule, which states:

$$P(a|b) = P(a \cap b) / P(b)$$

The goal of the MAP detector is to maximize the probability of guessing the input based on the output. The probability of the decision $m' = m_i$ being correct, given the channel output vector $\mathbf{y} = \mathbf{v}$, is [1]