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**ACKNOWLEDGEMENT**

Firstly, we would like to express our sincere gratitude to our advisor CSD Chairperson Khatalyn E. Mata for the continuous support of our research study, for his patience, motivation, and immense knowledge. His guidance helped us in all the time of research and writing of this thesis. We could not have imagined having a better advisor and mentor for our research study.

Besides our advisor, we would like to thank the rest of our thesis committee: Prof. Marian Rose Yu, and CSD Chairperson Khatalyn E. Mata, for their insightful comments and encouragement, but also for the logical and hard question which incented us to widen our research from various perspectives.

We are grateful to our Prof. Khatalyn E. Mata, our coordinator, in the Computer Science Department. We are extremely thankful and indebted to her for sharing expertise, and sincere and valuable guidance and encouragement extended to us.

Lastly, we would like to thank our parents for giving us unending support and motivation for doing this research.

**ABSTRACT**

Facial Recognition had always been confronted with certain problems in producing reliable results regarding different factors. These factors can greatly affect the result of the recognition that can lower the accuracy of the algorithm. Such factors are; First, the variances in each image’s lighting condition; Second, the PCA’s *Dimension Reduction* that causes the processing level to increase significantly high; and Third, the susceptibility to recognize a person even when not yet registered into the system. In this study, our goal is to explore these issues in a mathematical manner and propose procedures to enhance the algorithm while still maintaining, or even improve, its efficiency as much as possible. We have tested and simulated the original algorithm and found that accuracy of Eigenface depends on many things. First problem, the accuracy would be greatly affected by varying light intensity. We applied a method where the input image’s light settings will be automatically adjusted before recognition occurs thus making the algorithm adaptive to various lighting environment settings. Second problem, the system recognizes an input even if doesn’t exist in the system. We have applied a common threshold before comparing eigenface to avoid false recognition. Third problem, using Dimension Reduction, the computation of the covariance matrix can significantly heighten process levels. We have devised a method where the number of trained faces ***M*** is comparedfromthe squared of the size of the image ***N2*** before continuing with the computation selecting the best computation available.

**Keywords: Eigenface, Principal Component Analysis, Dimension Reduction, mathematical, recognition, illumination variations, grayscale, covariace matrix.**