USC University of Southern California

USC Viterbi School of Engineering

Ming Hsieh Department of Electrical Engineering

Age Group Classification via Fusion

Kuan-Hsien Liu, Shuicheng Yan and C.-C. Jay Kuo

Ming Hsieh Department of Electrical Engineering and Signal and Image Processing Institute

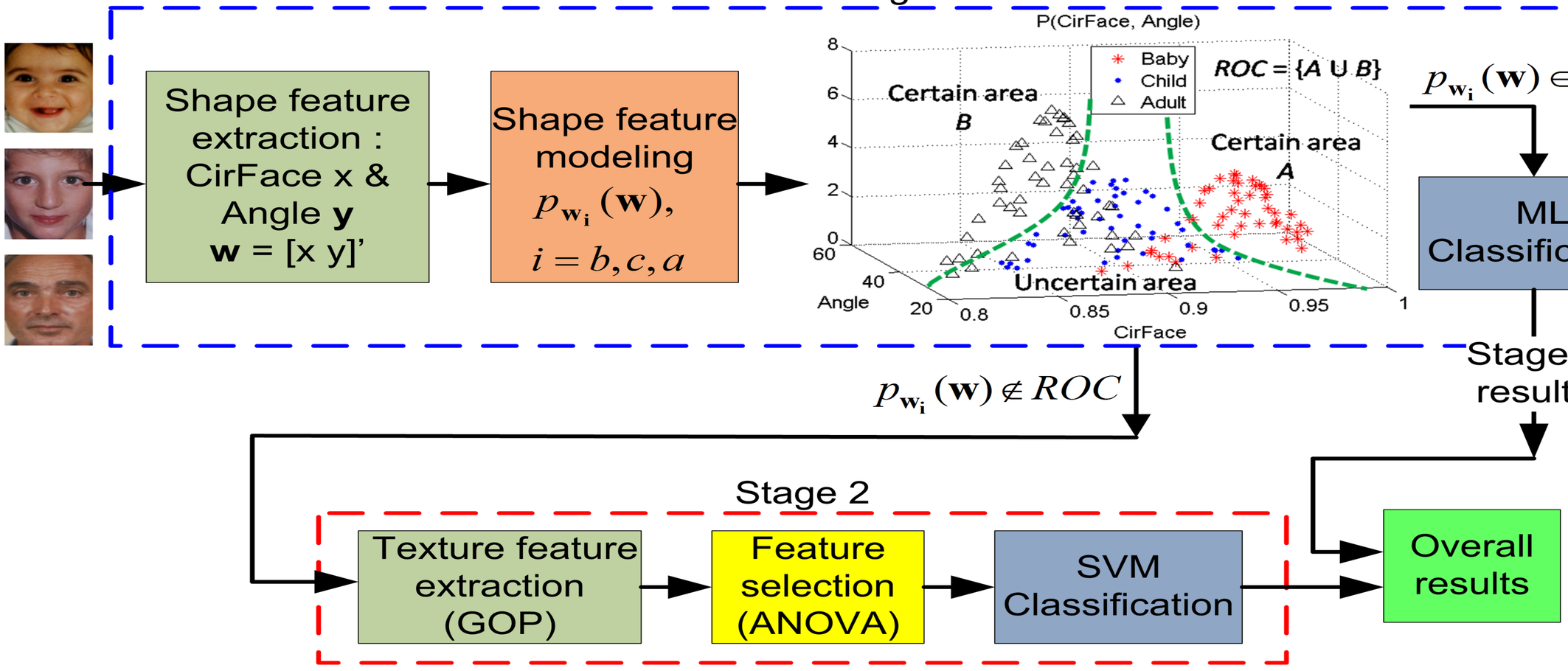
Introduction

We present a highly accurate two-stage method for age groups classification by fusing two types of human facial features.

In the first stage, two shape-based features, CirFace and Angle, are extracted from faces and used to determine whether a face is certain or uncertain for classification. The "certain" faces are classified using the maximum likelihood (ML) decision rule and "uncertain" faces are sent to the second stage.

In the second stage, a surface-based feature, known as the gradient orientation pyramid (GOP), is extracted from facial images and, then, the analysis of variance (ANOVA) feature selection technique is applied to these features to further select significant features for classification by an SVM classifier.

Method



Experimental Results

Shape feature	Classification Rate (%)			
	Baby	Child	Adult	Average
CirFace (new)	84	54	82	**73.3**
Angle (new)	68	58	86	**70.7**
Ratio 1 [21]	56	50	58	54.7
Ratio 2 [21]	62	44	88	64.7

GOP+SVM

Database	Baby	Child	Adult	Senior	Average Rate
FG-NET	82. 8%	68.6%	69.7%	--	71.1%
MORPH	--	93.7%	76.2%	72.1%	80.6%

GOP+ANOVA+SVM

Database	Baby	Child	Adult	Senior	Average Rate
FG-NET	92.1%	91.9%	90.1%	--	91.4%
MORPH	--	96.1%	88.1%	86.8%	90.3%

Method	FG-NET	MORPH
Wrinkle [19]	69.7%	68.1%
HOG + PNN [18]	78.5%	80.3%
LBP + KNN [15]	71.3%	72.6%
GOP+ANOVA+SVM (new)	91.4%	90.3%
CirFace & Angle + GOP+ANOVA+SVM (new)	**95.1%**	**93.7%**

Conclusion & Future Work

- **We proposed a facial age groups classification system using a conjunction of shape- and surface-feature based classifiers. Two new shape features were developed and a new surface feature based method was designed. By setting a ROC to jointly classify the facial images with two stages, the resulting system gave a highly accurate classification result. Experimental results demonstrated that the proposed method outperforms the state-of-the-art methods.**
- **We will explore other shape features and fuse different shape features together. Also, we may consider the effects of the number of pyramid layers for GOP and use/combine other surface-based features. Besides, different classifiers can be tested and compared. More than three age groups classification problem will also be an interesting and challenging topic.**

Contact information: liuk@usc.edu, eleyans@nus.edu.sg, cckuo@sipi.usc.edu

Ming Hsieh Institute
Ming Hsieh Department of Electrical Engineering