- Brief description of feature extraction technique proposed in paper

Choras 2009:- 9 novel parameters developed especially for lips biometrics and describing lips shape are:-

1. lips width to perimeter ratio WO given by: WO = W/O, where W is the lips width and O is lips perimeter.

2. Upper to lower lips height ratio ULH given by: ULH = H1/H2 where H1 is the upper lip height calculated in the middle column of the lips, and H2 is the lower lip height calculated in the middle column of the lips.

3. Upper lip height to width ratio ULW given by: ULW = H1/W where H1 is the upper lip height calculated in the middle column of the lips and W is the lips width.

4.Lower lip height to width ratio LLW given by: LLW = H2/W where H2 is the upper lip height calculated in the middle column of the lips and W is the lips width.

5. Inner to outer circle ratio C2C given by: C2C = pk/PK, where pk is the inner circle and PK is the outer circle.

6. Width to middle height ratio WMH given by:WMH = W/(H1 + H2).

7. Left side upper to lower lip convexity ratio LC given by: LC = m1/m2 where m1 is the upper lip left side convexity and m2 is lower lip left side convexity.

8. Right side upper to lower lip convexity ratio RC given by: RC = n1/n2 where n1 is the upper lip left side convexity and n2 is lower lip left side convexity.

9. Indent ratio IR given by: IR = H3/H where H is thelips height and H3 is the height of the indent calculated.

- Scale invariance of technique “Consistency of performance of models trained on extracted features over scale variation”

Choras 2009:- lip extraction an recognition techniques used in this paper is scale invarient because in this paper features are extracted by taking ratios of different features of a pair lips like, ratio of height of upper and lower lip, lips width to perimeter ratio, Upper lip height to width ratio, Lower lip height

to width ratio, Inner to outer circle ratio, Width to middle height ratio, Left side upper to lower lip convexity ratio, Right side upper to lower lip convexity, Indent ratio IR. So we can take picture from any distance the ratios will not change . The only thing which we will have to change is quality of camera because if we are taking images from a distance than we will have to use camera of very good quality. And the properties which are seen are global properties.

- Orientation Invariance “Consistency of performance of models trained on extracted features over orientation invariance “

Choras 2009:- The method this paper is using for lip extraction and recognition is extracting lips from face and than start checking for the parameters developed for lips biometrics. And as all of the parameters are working on the ratio of different features of a lips, than the ratio is going to be same for those features in every orientation.

- Lighting robustness and Color invariance “Consistency of performance of models trained on extracted features over lighting variation”

Choras 2009 :- The method in this paper for extracting lip from face is based on color difference between lip and skin of face and this is the drawback of this paper because while reading a face there maybe some inconsistency in intensity of light falling on the lip there maybe shadow on half of the lip than it will cause some errors but the methods of lip features extraction of this paper are lighting robust because methods are finding ratios different physical features of a lip and those feature do not change while changing light.

- Temporal permanence “Consistency of performance of models trained on extracted features over time”

Choras 2009:- The outcomes of the methods of this papers will not change over time because this paper is working on those physical features which do not change over time so this will work consistently over time.

- Use of local/global features “Specify whether local or global feature are used. Both are used preferred”

Choras 2009:- In this paper only global features are take care of like height, widht and other features of a lip no local features are used which kind of makes it more robust for orientation, lighting and temporal permanance.