Region based Extensive Response Index Pattern
For Facial Expression Recognition

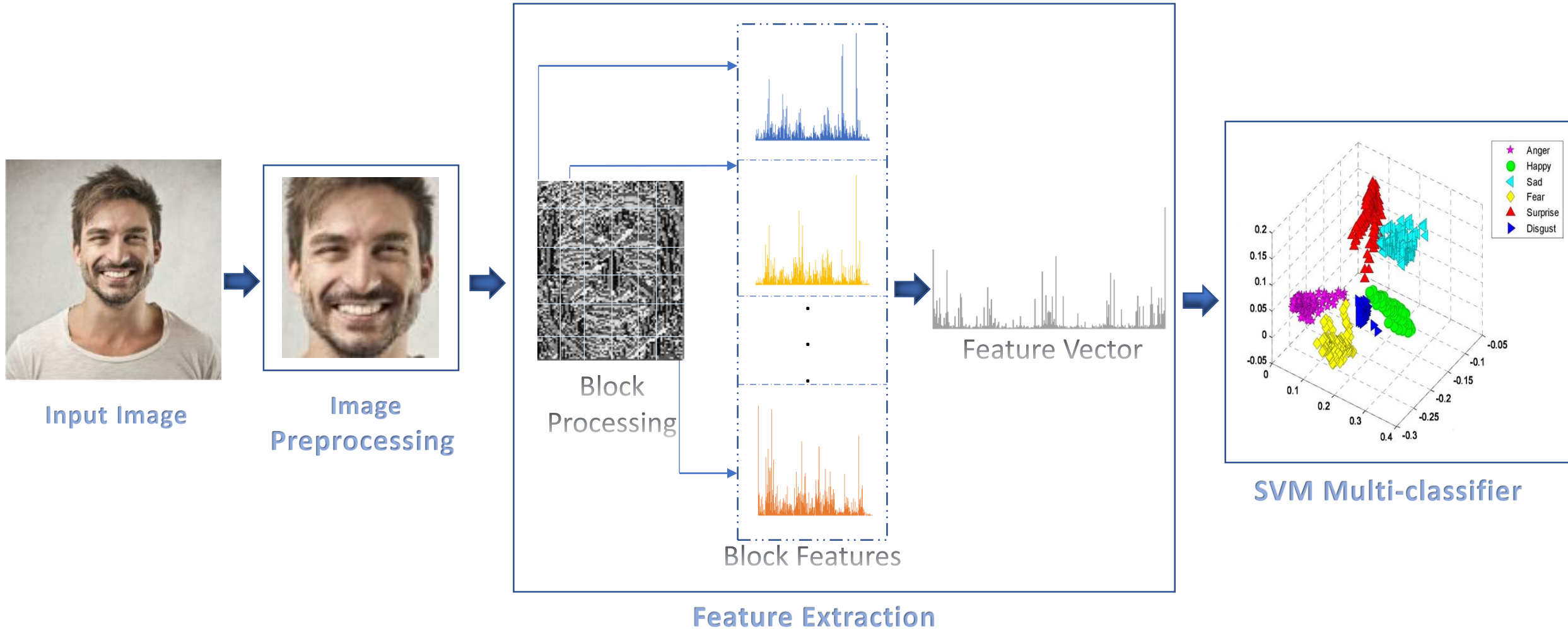By: Monu Verma

Proposed Method

Fig. 1. The overall process of proposed method
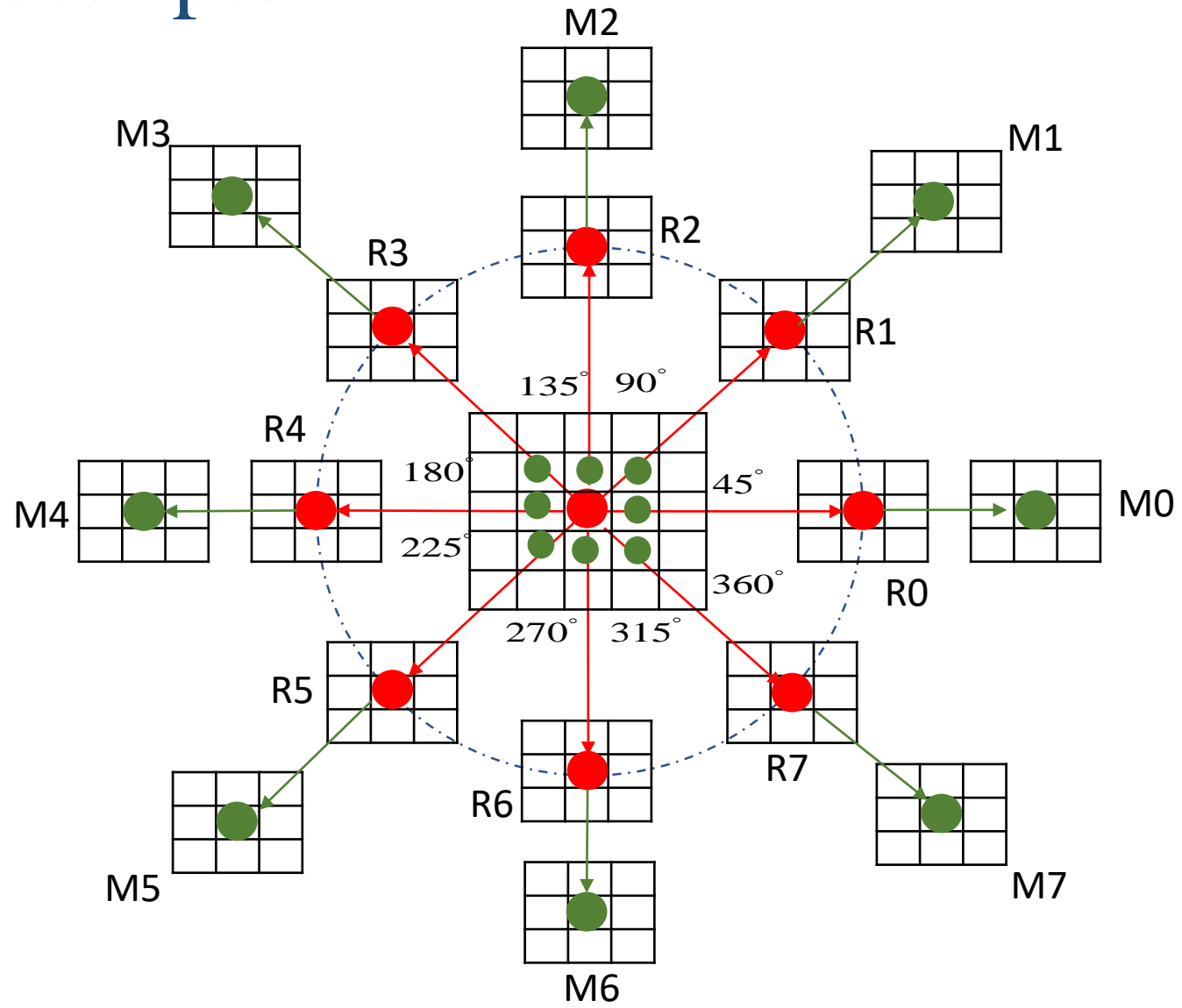
Proposed Descriptor

Fig. 2. Illustration of proposed RETRaIN descriptor
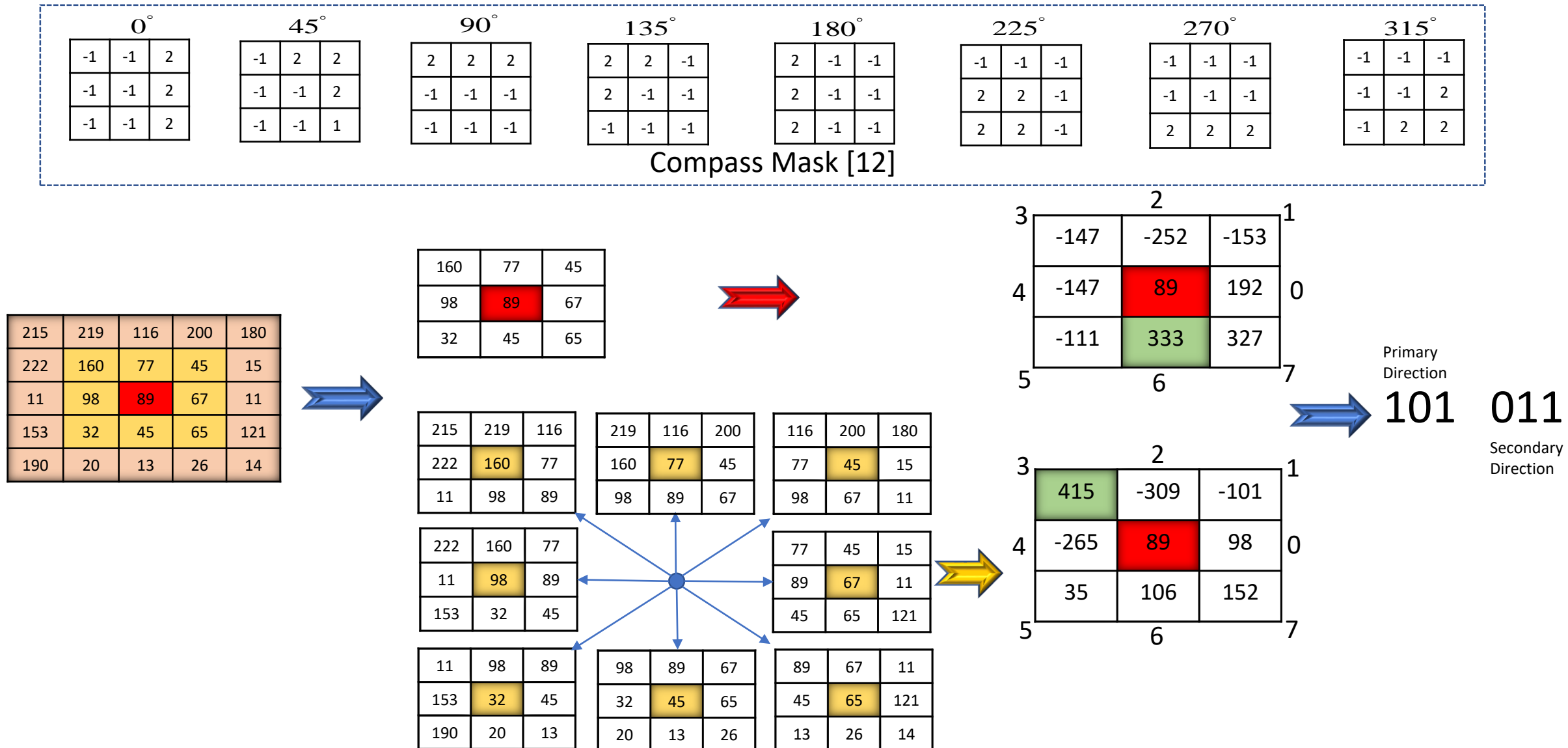
Proposed descriptor

Fig. 3. Encoding scheme of proposed descriptor

Advantages

- RETRaIN descriptor uses the directional information from edge responses, instead of actual intensity value to encode the texture pattern.

- Edge responses are less sensitive to illumination changes and random noise.

- RETRaIN extract the high edge responses from local and extensive regions that capture the more definite information of corner and edges.

- RETRaIN encodes the structure information into six-bit compact binary pattern that deliver more information with less space.

Databases

Extended CK

JAFFE

MUG
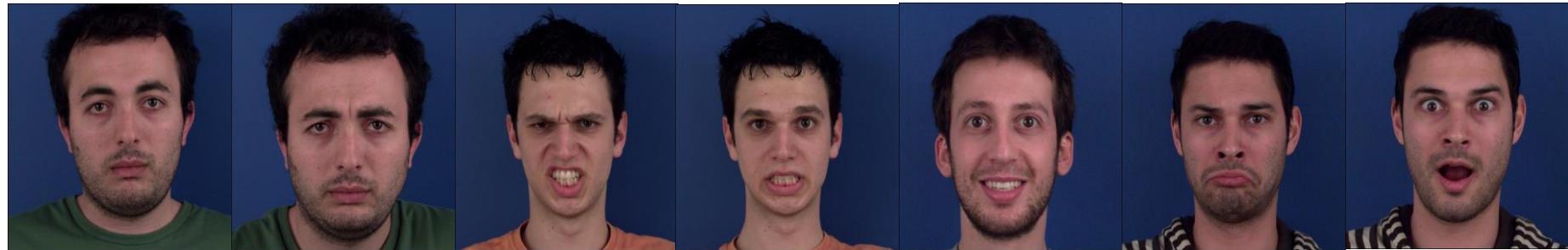
Neutral   Angry   Disgust   Fear   Happy   Sad   Surprise

Databases

	Neutral	Anger	Disgust	Fear	Happy	Sad	Surprise	Total
CK+	116	132	180	75	204	87	249	1043
JAFFE	30	30	30	30	30	30	30	210
MUG	255	260	250	241	255	245	255	1761

Experimental Results

TABLE II

Facial Expression Recognition rate (%) of RETRaIN and other methods on CK+, JAFFE and MUG Datasets for 6 and 7 class expressions

Method	CK +		JAFFE		MUG	
	6- class	7- class	6- class	7- class	6- class	7- class
LBP	93.46	89.00	86.11	85.23	99.20	98.40
CS- LBP	95	92.55	88.33	86.68	99.20	98.57
LDP	96.25	92.90	90.55	86.19	98.80	98.52
LDN	94.80	91.68	83.88	81.42	98.67	98.57
LDTP	95.28	91.86	90.55	85.71	98.87	98.57
RETRaIN	97.83	95.16	91.66	88.09	99.66	98.57

Experimental Results

TABLE III

Confusion matrix of CK+ dataset for 6 class facial expressions

	Anger	Disgust	Fear	Happy	Sad	Surprise
Anger	26	0	0	0	0	0
Disgust	1	35	0	0	0	0
Fear	0	0	15	0	0	0
Happy	0	0	0	39	2	0
Sad	0	0	0	0	17	0
Surprise	0	0	0	0	1	49

TABLE IV

Confusion matrix of CK+ dataset for 7 class facial expressions

	Neutral	Anger	Disgust	Fear	Happy	Sad	Surprise
Neutral	19	1	0	1	0	1	0
Anger	0	26	0	0	0	0	0
Disgust	0	1	33	0	0	1	1
Fear	0	0	0	15	0	0	0
Happy	0	0	0	0	40	1	0
Sad	1	0	0	1	0	15	0
Surprise	1	0	0	0	0	0	49

Experimental Results

TABLE V

Confusion matrix of JAFFE dataset for 6 class facial expressions

	Anger	Disgust	Fear	Happy	Sad	Surprise
Anger	6	0	0	0	0	0
Disgust	0	5	1	0	0	0
Fear	0	0	6	0	0	0
Happy	0	0	0	5	0	0
Sad	0	0	0	1	5	0
Surprise	0	0	0	0	0	6

TABLE VI

Confusion matrix of JAFFE dataset for 7 class facial expressions

	Neutral	Anger	Disgust	Fear	Happy	Sad	Surprise
Neutral	4	0	0	1	0	1	0
Anger	0	6	0	0	0	0	0
Disgust	0	0	6	0	0	0	0
Fear	1	0	0	5	0	0	0
Happy	0	0	0	0	6		0
Sad	1	0	0	1	0	4	0
Surprise	0	0	0	0	0	0	6

Experimental Results

TABLE VII

Confusion matrix of MUG dataset for 6 class facial expressions

	Anger	Disgust	Fear	Happy	Sad	Surprise
Anger	52	0	0	0	0	0
Disgust	0	50	0	0	0	0
Fear	0	0	48	0	0	0
Happy	0	1	0	50	2	0
Sad	0	0	0	0	49	0
Surprise	0	0	0	0	0	51

TABLE VIII

Confusion matrix of MUG dataset for 7 class facial expressions

	Neutral	Anger	Disgust	Fear	Happy	Sad	Surprise
Neutral	48	0	0	2	0	1	0
Anger	1	51	0	0	0	0	0
Disgust	0	0	50	0	0	0	0
Fear	1	0	0	47	0	0	0
Happy	0	0	0	0	51	0	0
Sad	0	0	0	0	0	49	0
Surprise	0	0	0	0	0	0	51

Conclusion

- This paper presents a novel descriptor Region based Extensive Response Index Pattern (RETRaIN) for facial expression recognition.

- RETRaIN encodes texture by analyzing relation among the reference and neighboring pixels by considering their orientations.

- RETRaIN uses the directional information instead of actual intensity value, that make it more robust compare to existing descriptors.

- RETRaIN encoded six bit pattern by extracting direction numbers of high edge responses, which is generated by applying directional compass mask.

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