Read and Recognition of old Kannada Stone Inscriptions Characters using MSDD Algorithm

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Abstract*— Invention of computer has made remarkable impact in all walks of life. Computer vision or Machine Vision has made our life simple and more dynamic. In the present work a successful attempt has been made using computer version technique to recognize and read the stone inscriptions belongs to ancient Kannada Characters. Conventional method is preparing such digital document take enormous amount of time, energy and money. The present approach provides an easy method of digitalization of stone inscriptions using simple camera. The techniques used here is simple and effective in removing noise and to recognize the characters in different condition like faded and unprotected old stone inscriptions.

In this work a novel approach called Mean, Standard deviation and Sum of Absolute difference Algorithm (MSDDA) is proposed Here in the present work, the Hoysala and Ganga periods characters are stored in a template. The character is identified based on its Mean, standard deviation and sum of absolute difference values. The corresponding recognized characters are converts into present Kannada script. An experimental result demonstrates high accuracy and better time efficiency in recognizing old Kannada stone inscriptions.

***Keywords*— Mean, standard deviation and Sum of Absolute difference Algorithm (MSDDA), Mean value coefficient. Standard deviation**

I. INTRODUCTION

Kannada language has 2000 year of history and Karnataka is ruled by so many of dynasty. Ganga and Hoysala rulers were originally from Malnad Karnataka, an elevated region in the Western Ghats range. The Hoysala and Ganga era was an important period in the development of art, architecture, and religion in South India. The empires is remembered today primarily for its temple architecture. Over a hundred surviving temples are scattered across Karnataka, including the well-known Chennakesava Temple at Belur, the Hoysaleswara Temple at Halebidu, and the Kesava Temple at Somanathapura.

In the present work we propose Mean, Standard Deviation and Sum of Absolute difference Algorithm (MSDDA) to recognize Hoysala and Ganga periods characters. In this work, the database of Hoysala and Ganga periods stone inscriptions characters are stored in .jpg and .wave format. The user can choose any characters in the test image. When they select at that time, it segment that characters and performs pre-processing and it extract features from those characters. Depending on extracted feature the algorithm calculates mean and standard deviation values of corresponding characters and finally it compare that calculated value of the same with database characters and it recognizes the corresponding characters.

II. PROPOSED ALGORITHM

The Algorithm flow is shown in figure.l

A. Database creation of Ganga and Hoysala phase Kannada characters.

B. Test image:
Here first capture Kannada Stone inscriptions images using normal digital camera

C Characters selection:
In this user can select any four characters simultaneously in test image.

D. Pre-processing
Selected characters are pre-processed and feature extraction can be done.

E. Mean standard deviation and Sum of Absolute difference Algorithm (MSDDA).
In this step, the preprocessed characters will be recognize based on its feature extraction and mean, standard deviation averaging values

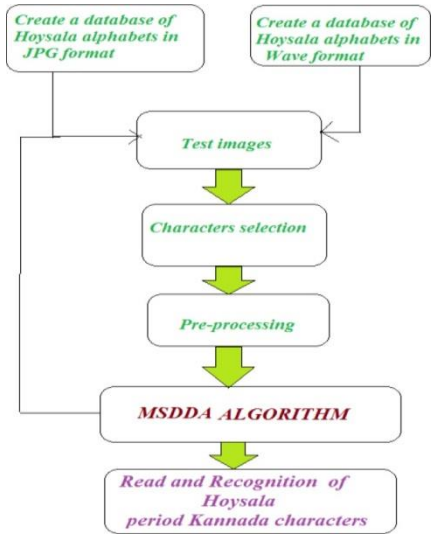

Figure 1: Flow chart of present work.

III. METHODOLOGY AND IMPLEMENTATION

A. Old Kannada Stone inscriptions

In this proposal, 12° century Hoysala and Ganga periods Stone inscriptions in Doddagavanahalli near 10KM from Hassan are captured. More than 50 images of old Kannada stone inscriptions are captured and selected only 2 exigent Hoysala, Ganga stone inscriptions for better recognition. Selected captured Hoysala and Ganga period stone inscriptions are shown below Figure 2a & 2b.

Figure 2a: Captured Hoysala period 12th century stone inscriptions

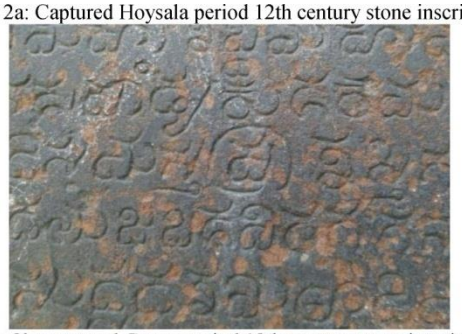

Figure 2b: captured Ganga period 12th century stone inscriptions

B. Pre-processing

1) Gaussian filtering

Gaussian filtering is used to blur images and remove noise and detail. In one dimension, the Gaussian function is as

G(x)=(1/(Sqrt(2pie * sigma)))e^ (x^2/sigma^2)

Where σ is the standard deviation of the distribution. We have Also assume that the distribution has a mean of zero (i.e. it is centered on the line x=0).

2) Edge detection

Here Sobel edge detection technique is used and Sobel calculates maximum gradient of image and it perform smoothing of image ,if image is smooth then the information found in that can easily extract.

3) Opening

The edge detected image is very thin so dilation followed by erosion is a perform called opening. It increases the thickness of edge detected image and dilation combines two similar pixels like AUB and erosion performs ABB.

4) Characters reconstruction

The opened image contains some breaking border and that border is reconstructed by filling of holes. Reconstruction is a process of constructing an image by filling pixel into broken border and this reconstruction is very important for character recognition.

C. Mean standard deviation and Sum of Absolute difference Algorithm (MSDDA).

1) Database: Store selected old and current alphabets in JPG format with each image having size 24*42 dimensions.

2) Image mean value: Calculate mean value of database and test images. Mean calculates the average pixel value of each image.

3) Standard deviation. Standard deviation is a square of some co-efficient. This is a second computation process in image. The standard deviation (SD) measures the amount of variation or dispersion from the average.

Let X be a random variable with mean value

$$SD = = BE [X-p] \quad (2)$$

4) Averaging

In this it calculates average of mean and standard deviation and for accurate recognition averaging of Mean and standard deviation is performed.

$$AVG = (MV+SD)/2 \quad (3)$$

5) Sum of absolute difference

Absolute difference measures the two difference points. Here in this it calculates test image and database images averaged difference value.

SAD= AVG Test image • AVG Database image (4)

When

MV=Mean Value
SD=Standard deviation
SAD=Sum of Absolute Value
AVG= Average

IV. RESULTS

l) Create database of Hoysala and Ganga period.

2) Test image

Capture some old stone inscriptions characters belong to Hoysala and Ganga periods using 16 Mega pixel ordinary digital cameras as shown in figure 3.

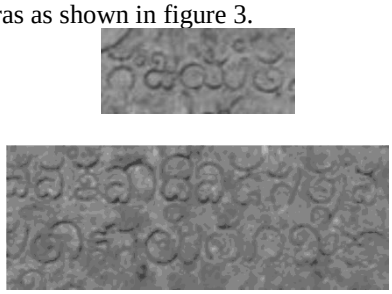

Figure 3: test images

3) Characters selection

In this step, characters will be select by user on their requirement as shown in figure 4

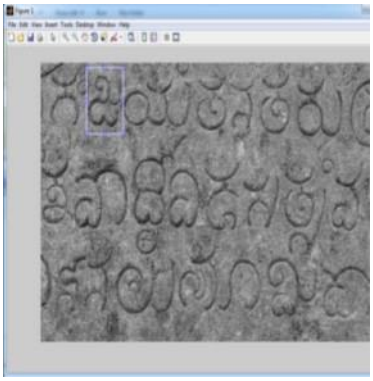

Figure 4: Characters selection in Stone inscriptions

In this proposal Ga, Ja, ya and Tha, characters of 12° century stone inscriptions are selected.

4) Pre-processing

The selected characters are preprocessed as shown in Figure 5.

Figure 5: pre-processed image

5) Mean, standard deviation and Sum of Absolute difference Algorithm (MSDDA)

In this calculation of mean, standard deviation value and sum of absolute difference value of image takes place and overall calculation and matching is performed by MSDDA algorithm and here the corresponding character is recognize on the basis of mean, standard deviation and sum of absolute value.

In table 1 show Mean, Standard deviation and absolute difference value of database images and test image as shown in table 1.

SAD=Avg(MV, SDyg9 • MV, SD of Data base images) (8)

When

SAD= Sum of Absolute Deference
SD=Standard deviation value MV=
Mean Value

Likewise it read and recognized all characters shown in figure 6

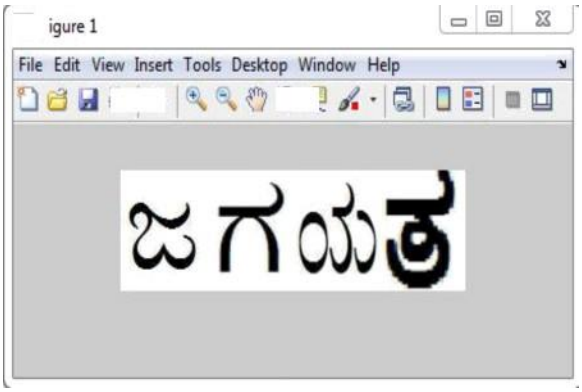

Figure 6: Read and Recognition of stone inscriptions Hoysala characters

TABLE 1: Mean and standard deviation and Sum of Absolute Deference values of test and database images

Images	*Mean Value (M(*	*Standard deviation value (SD)*	*Sum of Absolute Deference (SAD)*	*Recognition Status*
	173.05	121.0578	0	Recognized
ಬ	177.32	112.4213	4.2691	Not Recognized
ಪ	164.07	115.64	40.4788	Not Recognized
	163.05	121.9352	17.8327	Not Recognized
ಗ	132.57	122.0158	1.5532	Not Recognized
			8.0918	Not Recognized
	171.49	112.6063	13.9538	Not Recognized
ಳ	181.14	119.3058	44.6135	Not Recognized
ಖ	159 .09	121.0578	1.6958	Not Recognized
ಮ	128.43	114.8631	8.9729	Not Recognized

The Recognition rate is calculated using equation 6 and achieved rate is shown in Table 3, 4.
The Recognition rate is obtain by formula

$$\rho = (\sigma - \tau)/\beta \qquad (6)$$

When p —— *Recognition* rate, m= accurate match, 7 = inaccurate match, Q = Number of samples

TABLE 2: Hoysala Period stone inscription characters Recognition rate analysis

Test images	*Recognized Character*	σ	τ	$\rho(in\ \%)$
		10	0	100%
	ಗ	10	0	100%
	ಯ	19	¡	95%
	ತ	20	0	100%
	ಯ	20	0	100%
		20	0	100%
	ಳ	20	0	100%
		20	0	100%

TABLE 3: Ganga Period stone inscription characters Recognition rate analysis

Test images	*Recognized Character*	β	τ	$\rho(in\ \%)$
	ಜ	20	0	100%
	ಯ	20	0	100%
		19		95%
	———	20		100%
	ಬಾ	20	0	100%
	ಽ	19		95%
		20	0	100%

From above Table 2 and 3 the recognition rate is 98.75 % accuracy for Hoysala and Ganga stone inscriptions characters.

V. CONCLUSIONS

In this present work a novel method of old Kannada character recognition is developed. It is easy and useful Recognition method for to identify old Kannada characters. Here in this the digitalization of old Kannada inscriptions was performed and it helps a common man to knowing the present Kannada literature. The software developed has been tested with chosen through sixteen characters with 40 data sets. The result achieved is efficient with 98.75% accuracy.

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