



MAHESHTALA COLLEGE

BUDGE BUDGE TRUNK ROAD

KOLKATA-700139

Affiliated to University of Calcutta, Kolkata

Mobile No.: 033-24905010 / 7439501363 /6289482452

Key Indicator – 3.3

Research Publications and Awards

**Criterion 3 – Research, Innovations and
Extension**



MAHESHTALA COLLEGE

BUDGE BUDGE TRUNK ROAD, MAHESHTALA, KOLKATA – 700139
E-mail: maheshtalacollege@yahoo.com/ principal.maheshtalacollege@gmail.com
☎: 6289482452 (Office)
Website: www.maheshtalacollege.ac.in

Supporting documents attached as per DVV Findings

3.3.1: Number of research papers published per teacher in the Journals notified on UGC care list during the last five years

Revised - 6

3.3.1.1: Number of research papers in the Journals notified on UGC CARE list year wise during the last five years

2022	2021	2020	2019	2018
2	0	1	3	0

RDas

DR. RUMPA DAS
Principal
Maheshtala College
Kolkata-7000139





MAHESHTALA COLLEGE

BUDGE BUDGE TRUNK ROAD, MAHESHTALA, KOLKATA – 700139
E-mail: maheshtalacollege@yahoo.com/ principal.maheshtalacollege@gmail.com
☎: 6289482452 (Office)
Website: www.maheshtalacollege.ac.in

Annual Report (2019)

Number of research papers published per teacher in the Journals notified on UGC CARE list during the year 2019.

Number of published papers: 3

Title of Paper	Name of the author/s	Department	Name of journal	Calendar Year of publication	ISSN number	Link to article / paper / abstract of the article	Is it listed in UGC Care list
Pixel Value Ordering with Prediction Error Expansion Based High	Satyajit De	Computer Science	International Journal of Applied Engineering Research (IJAER)	2019	0973-4562	https://dx.doi.org/10.37622/IJAER/14.11.2019.2585-2595	Yes
Reversible Data Hiding Scheme using Prediction Error Expansion	Satyajit De	Computer Science	International Journal of Applied Engineering Research (IJAER)	2019	0973-4562	https://dx.doi.org/10.37622/IJAER/14.8.2019.2029-2037	Yes
Adjacent Pixel Values Blocking and Prediction Error Expansion	Satyajit De	Computer Science	International Journal of Applied Engineering Research (IJAER)	2019	0973-4562	https://dx.doi.org/10.37622/IJAER/14.11.2019.2585-2595	Yes

R Das

DR. RUMPA DAS
Principal
Maheshtala College
Kolkata-7000139





MAHESHTALA COLLEGE

BUDGE BUDGE TRUNK ROAD, MAHESHTALA, KOLKATA – 700139
E-mail: maheshtalacollege@yahoo.com/ principal.maheshtalacollege@gmail.com
☎: 6289482452 (Office)
Website: www.maheshtalacollege.ac.in

Name of the Author: Satyajit De, Maheshtala College

Web Link: <https://dx.doi.org/10.37622/IJAER/14.4.2019.997-1005>

Satyajit De, Pixel Value Ordering with Prediction Error Expansion Based High Fidelity Reversible Data Hiding Scheme, 2019

International Journal of Applied Engineering Research ISSN 0973-4562 Volume 14, Number 4 (2019) pp. 997-1005
© Research India Publications. <https://dx.doi.org/10.37622/IJAER/14.4.2019.997-1005>

Pixel Value Ordering with Prediction Error Expansion Based High Fidelity Reversible Data Hiding Scheme

Alok Haldar

*Department of Computer Science,
Kharagpur College, West Midnapur,
West Bengal, India.*

Satyajit De

*Department of Computer Science,
Maheshtala College, Budge Budge Trunk Road,
Kolkata-700141, West Bengal, India.*

Biswapati Jana

*Department of Computer Science,
Vidyasagar University, West Midnapur,
West Bengal, India.*

Abstract

This paper introduced a reversible data hiding method based on pixel value ordering with the prediction-error expansion technique and the average value of end pixels'. A host image is first segmented into non-overlapping sub-blocks of three pixels and ordered them as ascending order. For each sub-block maximum pixel value and the minimum pixel value is predicted by the middle pixel value and also the middle pixel value is predicted by the average of the maximum and minimum pixel values. Then by using prediction-error expansions, we can embed secret bits into maximum pixel and minimum pixel and also by using the average value of these two pixels we can embed secret bit into the middle pixel of every sub-block. All secret bits can be recovered and restored the cover image completely from watermarked image. Experimental result of this scheme demonstrates that the embedding capacity and average PSNR value is larger than another pixel value ordering and prediction error expansion based approach for relatively smooth images. Also, the visual quality of the obtained marked image is better than other Pixel Value Ordering and Prediction Error Expansion based method.

Keywords: Pixel-value ordering, Reversible data hiding, Prediction-error expansion, Average pixel value.

INTRODUCTION

Nowadays, data hiding has been found in different application such as authentication, ownership protection, and secret communication. The reversible data hiding (RDH) scheme is proposed to recover the original content from the marked one without any distortion. Here, reversible data hiding methods are the primary technique of lossless compression [1-6], difference expansion (DE) [7-10], histogram shifting (HS) [11-17], prediction-error expansion (PEE) [18-33], etc. Among them, an interesting research part is to achieve high-level image fidelity my modification of each pixel by at most 1. Recently, Li et al. [31] proposed a novel RDH based on pixel-value-ordering (PVO). For this method, the pixels in a block are sorted in ascending order to get (p_1, \dots, p_n) . Then, the maximum p_n is predicted by p_{n-1} . Finally, the pixel with

prediction-error of $p_n - p_{n-1} = 1$ is embedded with one data bit. Besides in [31], by also considering the minimum p_1 , i.e. predict p_1 using p_2 , two-bit can be embedded into a block at the same time. The experimental results reported in [31] show that the prediction using sorted pixel values is more accurate than the previous methods. The marked image fidelity can be significantly improved by [31]. Huang et al. applied the utilization rate and histogram shift to a high bit-depth of volume structure on medical images [12]. Ni et al. proposed a new lossless data hiding based on a histogram modification, where the zero or minimum points of the image histogram are utilized [17]. Thodi and Rodriguez proposed a reversible data hiding method using prediction-error expansion. Hu et al. proposed an improved reversible data hiding by reducing the overflow location map. Li et al. Proposed an improvement by using adaptive embedding and pixel selection. Lee et al. proposed a reversible data hiding scheme that is free of location map and a corresponding predictive value is derived from the average of its adjacency pixels to make little bit predictive errors.

Li et al. proposed a reversible data hiding scheme [1] using pixel-value-ordering and prediction-error expansion. After sorting in ascending order of every non-overlapped sub-block of equal sizes, the second maximum or minimum pixel value was used to predict the maximum pixel or minimum pixel value respectively. Then by applying prediction-error expansion technique secret data was embedded. Best result was achieved in this technique by using 2×2 sub-blocks i.e. 4 pixels' sub-block. But for this method, maximum pixels are not used to improve the embedding capacity as well as the image quality for every sub-block and this improvement is done by Jung's method.

Jung's proposed a reversible data hiding scheme [2] using pixel-value-ordering and prediction-error expansion. To improve Li et al's scheme Jung's divide the cover image into three pixels non-overlapped sub-blocks. For each sub-block, sorted the pixels in ascending order and then the second largest pixel value was used to predict the maximum pixel value. Then to embed secret data prediction error expansion was applied into it. As a result, high embedding capacity and

R Das

DR. RUMPA DAS
Principal
Maheshtala College
Kolkata-7000139





MAHESHTALA COLLEGE

BUDGE BUDGE TRUNK ROAD, MAHESHTALA, KOLKATA – 700139
E-mail: maheshtalacollege@yahoo.com/ principal.maheshtalacollege@gmail.com
☎: 6289482452 (Office)
Website: www.maheshtalacollege.ac.in

Satyajit De, Pixel Value Ordering with Prediction Error Expansion Based High Fidelity Reversible Data Hiding Scheme, 2019

Proof of UGC approved journal: International Journal of Applied Engineering Research

5/3/2019

Welcome to UGC, New Delhi, India



विश्वविद्यालय अनुदान आयोग
University Grants Commission
quality higher education for all

- (<https://www.ugc.ac.in/>)
- Event (<https://www.ugc.ac.in/subpage/events.aspx>)
- RTI (<https://www.ugc.ac.in/subpage/RTI-Act.aspx>)
- Tenders (<https://www.ugc.ac.in/Tenders.aspx>)
- Jobs (https://www.ugc.ac.in/ugc_jobs.aspx)
- Press Release (https://www.ugc.ac.in/ugc_pressrelease.aspx)
- Contact Us (<https://www.ugc.ac.in/contact.aspx>)
- Hindi (https://www.ugc.ac.in/hindi_new/)



UGC Approved List of Journals

You searched for **INTERNATIONAL JOURNAL OF APPLIED ENGINEERING RESEARCH**

[Home](#)
[\(journal_list.aspx\)](#)

Total Journals : 1

Show entries Search:

View	Sl.No.	Journal No	Title	Publisher	ISSN	E-ISSN
View (ugc_admin_journal_report.aspx?eid=NjQ1Mjk=")	1	64529	International Journal of Applied Engineering Research	Research India Publications	09734562	

Showing 1 to 1 of 1 entries Previous Next

RDas

DR. RUMPA DAS
Principal
Maheshtala College
Kolkata-7000139





MAHESHTALA COLLEGE

BUDGE BUDGE TRUNK ROAD, MAHESHTALA, KOLKATA – 700139
E-mail: maheshtalacollege@yahoo.com/ principal.maheshtalacollege@gmail.com
☎: 6289482452 (Office)
Website: www.maheshtalacollege.ac.in

Name of the Author: Satyajit De, Maheshtala College

Web Link: <https://dx.doi.org/10.37622/IJAER/14.8.2019.2029-2037>

Satyajit De, Reversible Data hiding Scheme using Prediction Error Expansion in Pixel Value Blocking and Ordering, 2019

International Journal of Applied Engineering Research ISSN 0973-4562 Volume 14, Number 8 (2019) pp. 2029-2037
© Research India Publications. <https://dx.doi.org/10.37622/IJAER/14.8.2019.2029-2037>

Reversible Data Hiding Scheme using Prediction Error Expansion in Pixel Value Blocking and Ordering

Satyajit De

Department of Computer Science,
Maheshtala College, Budge Budge Trunk Road,
Kolkata-700141, West Bengal, India. Email:

Alok Haldar

Department of Computer Science,
Kharagpur College, West Midnapur,
West Bengal, India.

Biswapati Jana

Department of Computer Science,
Vidyasagar University, West Midnapur,
West Bengal, India.

Abstract

This paper presents a better reversible data hiding method depending on pixel value ordering and prediction-error expansion technique. A host image is first segmented into non-overlapping sub-blocks of adjacent three pixels and ordered them as ascending order. For each sub-block, the maximum pixel value is predicted by the second maximum pixel value. Then the second maximum pixel value is predicted by the minimum pixel value or minimum pixel value is predicted by the second maximum pixel value. Then by using prediction-error expansions, we can insert one or two secret bits into every sub-block pixels and also we can recover the hidden secret bits and restore the cover image fully from watermarked image. Experimental results of this method demonstrate that the embedding capacity and PSNR value is larger than another pixel value ordering and prediction error expansion based approach. Also, the visual quality of the obtained marked image is better than other PVO and PEE based method.

Keywords: Pixel-value ordering, Reversible data hiding, Prediction-error expansion, Adjacent pixel grouping.

INTRODUCTION

In the spatial domain different reversible data hiding methods have been divided as lossless compression [3-4], difference expansion (DE) [5-8], histogram shifting (HS) [11-12], prediction-error expansion (PEE) [15], etc. in the spatial domain. DE technique and LSB embedding scheme are used to get a minimum image distortion with high embedding capacity. In adjacent pixels blocks, Alattar applied difference expansion technique to embedded secret bits [7]. To increase the embedding capacity, Al-Qershi et al. used a two-dimensional difference expansion technique (2D-DE) with a threshold value depending on the image behavior [8]. The multilevel histogram technique is used by Zhao et al. to embed more secret bits [11]. In his method to enhance embedding capacity secret bits are modulated by using more peak points. Luo et al. generate a strong connection among different pixel blocks to produce a difference histogram and multi-level histogram shifting to embed the secret data [10].

A lossless data hiding method based on a histogram modification is proposed by Ni et al., where the zero or minimum points of the image histogram are utilized [17].

A reversible data hiding method with prediction-error expansion is introduced by Thodi and Rodriguez.

Hu et al. introduced a modify reversible data hiding scheme by reducing the overflow location map. Li et al. Proposed an improvement by using adaptive embedding and pixel selection. Lee et al. proposed a reversible data hiding scheme that is free of location map and a corresponding predictive value is derived from the average of its adjacency pixels to make little bit predictive errors.

Li et al. proposed a reversible data hiding scheme [1] using pixel-value-ordering and prediction-error expansion. After sorting in ascending order of every non-overlapped sub-block of equal sizes, the second maximum or minimum pixel value was used to predict the maximum pixel or minimum pixel value respectively. Then by applying prediction-error expansion technique secret data was embedded. Best result was achieved in this technique by using 2x2 sub-blocks i.e. 4 pixels' sub-block. But for this method, maximum pixels are not used to improve the embedding capacity as well as the image quality for every sub-block and this improvement is done by Jung's method.

Jung's proposed a reversible data hiding scheme [2] using pixel-value-ordering and prediction-error expansion. To improve Li et al's scheme Jung's divide the cover image into three pixels non-overlapped sub-blocks. For each sub-block, sorted the pixels in ascending order and then the second largest pixel value was used to predict the maximum pixel value. Then to embed secret data prediction error expansion was applied into it. As a result, high embedding capacity and good image quality occurs than Li et al's method. But still there is a space available to improve the embedding capacity as well as the image quality for every sub-block and this improvement is done by the proposed method.

In this paper to improve Jung's method a new reversible data hiding scheme is proposed for three pixels' sub-blocks based on pixel value ordering with prediction error expansion. Three pixels of each sub-blocks are ordered in ascending order and

R Das

DR. RUMPA DAS
Principal
Maheshtala College
Kolkata-7000139





MAHESHTALA COLLEGE

BUDGE BUDGE TRUNK ROAD, MAHESHTALA, KOLKATA – 700139
E-mail: maheshtalacollege@yahoo.com/ principal.maheshtalacollege@gmail.com
☎: 6289482452 (Office)
Website: www.maheshtalacollege.ac.in

Name of the Author: Satyajit De, Maheshtala College

Web Link: <https://dx.doi.org/10.37622/IJAER/14.11.2019.2585-2595>

Satyajit De, Adjacent Pixel Values Blocking and Prediction Error Expansion Based High Fidelity Reversible Data Hiding Scheme, 2019

International Journal of Applied Engineering Research ISSN 0973-4562 Volume 14, Number 11 (2019) pp. 2585-2595
© Research India Publications. <https://dx.doi.org/10.37622/IJAER/14.11.2019.2585-2595>

Adjacent Pixel Values Blocking and Prediction Error Expansion Based High Fidelity Reversible Data Hiding Scheme

Satyajit De

*Assistant Professor
Department of Computer Science,
Maheshtala College, Budge Budge Trunk Road,
Kolkata-700141, West Bengal, India.*

Abstract

This paper presents a novel reversible data hiding method based on pixel value blocking and prediction-error expansion. A cover image is divided into non-overlapping sub-blocks of two pixels. Watermark bits are embedded in two phases. In Phase-I, for each sub-block, second pixel value is predicted by the first pixel value and depending on prediction-error within a threshold limit secret bit is embedded into second pixel. Also secret bit is embedded into first pixel just by adjusting the location map without effecting into the pixel value. Then another compressed location map value is used to indicate overflow/underflow or the sub-blocks are outer threshold limit. Again in Phase-II, for each sub-block, first pixel value is predicted by the second pixel value and by depending on prediction-error within a threshold limit secret bit is embedded into first pixel. Also secret bit is embedded into second pixel by adjusting location map without effecting into the pixel value and another compressed location map value is used to indicate overflow/underflow or the sub-blocks of outer threshold limit. All secret bits can be recovered and restored the cover image completely from watermarked image. Experimental result of comparison of this scheme with recent existing scheme using different standard images shows that the embedding capacity with visual quality and PSNR values of the proposed scheme is larger than the existing scheme.

Keywords: Reversible data hiding, Prediction-error expansion, Threshold limit, Compressed location map, Peak signal-to-noise ratio (PSNR).

INTRODUCTION

Today large amount of digital data like text, images, audios and videos are transmitted using internet with the growth of information and communication technology [1,2]. Unauthorized users or attackers can easily alter, copy, delete or tamper these information during the transmission. Such problems can have recovered by using Watermark or Digital signature. Digital watermarking is a method of embedding secret data (or watermark data) into the digital multimedia content in such a way that the marked signal is perceptually indistinguishable from original cover image [3].

Reversible data hiding is a process of "lossless data hiding". It is a special type of fragile digital data hiding scheme that can extract all hidden secret bits from watermarked media and can recover the watermarked media in its original form without loss of any information. In the spatial domain categorically

RDH can be divided as DE (difference expansion), lossless compression, HS (histogram shifting) [4] and also PEE (prediction error expansion) [5].

Many reversible data hiding scheme with lossless data compressions method are proposed by Fridrich et al. [6] and Celik et al. [7] and others. In this scheme compressed watermark bits are stored by replacing some pixels of a cover image. To decrease the visual distortion compressed watermark bits are stored by replacing LSB of cover images [7].

To get a minimum image distortion with high embedding capacity DE techniques are used. Varieties difference expansion reversible data hiding schemes are proposed in [8,9,10,11]. The concept of difference expansion is first introduced by Tian [8]. Alattar [9] applied DE technique to embedded secret bits in adjacent pixel blocks. To increase the embedding capacity, Al-Qershi et al. [11] used two-dimensional difference expansion technique (2D-DE) with a threshold value depending on the image behaviour.

A lossless reversible data hiding method based on histogram modification is first proposed by Ni et al. [12]. In this method of histogram bin shifting peak point and zero point of the histogram of the image are used. The multilevel histogram technique is used by Zhao et al. to embed more secret bits [13]. In his method to enhance embedding capacity secret bits are modulated by using more peak points. Huang et al. proposed another reversible watermarking scheme with histogram bin shifting technique [14]. Luo et al. generate a strong connection among different pixel blocks to produce a difference histogram and multi-level histogram shifting to embed the secret data [15].

Thodi and Rodriguez [16] proposed a reversible data hiding method with prediction-error expansion. Hu et al. [17] introduced a modify reversible data hiding scheme by reducing the overflow location map. Li et al. proposed an improvement by using adaptive embedding and pixel selection [18]. Lee et al. proposed a reversible data hiding scheme that is free of location map and a corresponding predictive value is derived from the average of its adjacency pixels to make little bit predictive errors [19].

To get low distortion and high embedding capacity, Jaiswal et al. [20] proposed an additive prediction error based reversible data hiding technique. It is an interpolation based method that predicts pixels using varieties structured predictors in different order. Kumar et al's represent [21] a reversible data hiding

R Das

DR. RUMPA DAS
Principal
Maheshtala College
Kolkata-7000139





MAHESHTALA COLLEGE

BUDGE BUDGE TRUNK ROAD, MAHESHTALA, KOLKATA – 700139
E-mail: maheshtalacollege@yahoo.com/ principal.maheshtalacollege@gmail.com
☎: 6289482452 (Office)
Website: www.maheshtalacollege.ac.in

Satyajit De, Adjacent Pixel Values Blocking and Prediction Error Expansion Based High Fidelity Reversible Data Hiding Scheme, 2019

Proof of UGC approved journal: International Journal of Applied Engineering Research

3/8/2019

Welcome to UGC, New Delhi, India



विश्वविद्यालय अनुदान आयोग
University Grants Commission
quality higher education for all

(<https://www.ugc.ac.in>)

Event (<https://www.ugc.ac.in/subpage/events.aspx>)

RTI (<https://www.ugc.ac.in/subpage/RTI-Act.aspx>)

Tenders (<https://www.ugc.ac.in/Tenders.aspx>)

Jobs (https://www.ugc.ac.in/ugc_jobs.aspx)

Press Release (https://www.ugc.ac.in/ugc_pressrelease.aspx)

Contact Us (<https://www.ugc.ac.in/contact.aspx>)

(<https://www.ugc.ac.in/hindi/>)



UGC Approved List of Journals

You searched for **INTERNATIONAL JOURNAL OF APPLIED ENGINEERING RESEARCH**

|| Home
(journal_list.aspx) ||

Total Journals : 1

Show entries Search:

View	Sl.No.	Journal No	Title	Publisher	ISSN	E-ISSN
View	1	64529	International Journal of Applied Engineering Research	Research India Publications	09734562	

Showing 1 to 1 of 1 entries Previous Next

RDas

DR. RUMPA DAS
Principal
Maheshtala College
Kolkata-7000139





MAHESHTALA COLLEGE

BUDGE BUDGE TRUNK ROAD, MAHESHTALA, KOLKATA – 700139
E-mail: maheshtalacollege@yahoo.com/ principal.maheshtalacollege@gmail.com
☎: 6289482452 (Office)
Website: www.maheshtalacollege.ac.in

Annual Report (2020)

Number of research papers published per teacher in the Journals notified on UGC CARE list during the year 2020.

Number of published papers: 1

Title of Paper	Name of the author/s	Department	Name of journal	Calendar Year of publication	ISSN number	Link to article / paper / abstract of the article	Is it listed in UGC Care list
GNSSer taty ebong khetra samikhaier proयोग : ekti alochona	Dr. Deepa Bhattacharjee	Geography	Bhugol Swadesh Charcha (Print Only)	2020	2581-4788	https://www.maheshtalacollege.ac.in/research-papers	Yes

R Das

DR. RUMPA DAS
Principal
Maheshtala College
Kolkata-7000139





MAHESHTALA COLLEGE

BUDGE BUDGE TRUNK ROAD, MAHESHTALA, KOLKATA – 700139
E-mail: maheshtalacollege@yahoo.com/ principal.maheshtalacollege@gmail.com
☎: 6289482452 (Office)
Website: www.maheshtalacollege.ac.in

Name of the Author: Dr. Deepa Bhattacharjee, Assistant Professor, Maheshtala College

URL Link: <https://www.maheshtalacollege.ac.in/research-papers>

Dr. Deepa Bhattacharjee, G.N.S.S. –er tatyo ebong khetro samikhai er proyog : ekti alochona, 2020

ভূগোল ব্রহ্মদেশ চর্চা
15th Year, Volume-1 • June 2020
Registration No : Wbhen / 2007 / 21524 • ISSN 2581-4788

**জি. এন. এস. এস.-এর তত্ত্ব এবং ক্ষেত্র সমীক্ষায় এর প্রয়োগ :
একটি আলোচনা**

ড. দীপা ভট্টাচার্য*, ড. রূপম কুমার দত্ত**

ভূমিকা : বর্তমান রচনায় জি.এন.এস.এস. এর কিছু তত্ত্ব এবং ক্ষেত্রসমীক্ষায় এর প্রয়োগ সম্বন্ধে আলোচনা করা হয়েছে। এই রচনার মূল উদ্দেশ্য হল জি. পি. এস. -এর কিছু মুখ্য বৈশিষ্ট্য আলোচনা করা এবং এর প্রয়োগ ঘটিয়ে ক্ষেত্র সমীক্ষায় কিভাবে এই ব্যবস্থাটিকে ব্যবহার করা যায় সেই সম্বন্ধে সংক্ষিপ্ত বিবরণ দেওয়া। এই রচনাটি ছাত্রছাত্রী ও অনেক গবেষকের কাছে জি.এন.এস.এস.-এর মূল বিষয় ও ব্যবহার সম্বন্ধে অনেকটা স্বচ্ছ ধারণা দেবে আশা করা যায়। ভূগোল ও অন্যান্য স্থানিক বিজ্ঞান (Spatial Science)-এর অধ্যয়নের ক্ষেত্রে এবং ভৌগোলিক তথ্য ব্যবস্থা-র আধুনিকতার মাত্রা প্রদানের জি.পি.এস.-এর ভূমিকা অনস্বীকার্য। বর্তমান পর্যালোচনার বিষয়বস্তু মূলত প্রত্যক্ষ অভিজ্ঞতা ও বিভিন্ন গবেষকদের প্রদত্ত তথ্যকে ভিত্তি করে রচনা করা হয়েছে।

জি.এন.এস.এস.-এর ধারণা :

উপগ্রহ ভিত্তিক দিক বা স্থানাঙ্ক নির্দেশক ব্যবস্থার দ্বারা পৃথিবীর যে কোন স্থানের নির্দিষ্ট সময় সাপেক্ষ অক্ষাংশ, দ্রাঘিমাংশ এবং উচ্চতা নির্ণয় করা সম্ভব হয়। এটি সম্পন্ন হয় মূলত উপগ্রহ প্রেরিত তথ্যের মাধ্যমে। এই পদ্ধতিতে একটি ছোট্ট বিদ্যুৎচালিত তথ্য গ্রাহক (Receiver) থাকে যা উপগ্রহ প্রেরিত এই তথ্যগুলি (অক্ষাংশ, দ্রাঘিমাংশ, উচ্চতা, সময়) সংগ্রহ করে। এই উপগ্রহ প্রেরিত তথ্যগুলি বৈজ্ঞানিক সমীক্ষার ভিত্তি হিসাবে ব্যবহৃত হয়। উপগ্রহ নির্ভর পৃথিবীর এই স্থানাঙ্ক নির্দেশক ব্যবস্থাকেই গ্লোবাল ন্যাভিগেশন স্যাটেলাইট সিস্টেম (GNSS) বলা হয়ে থাকে।

২০১১ সাল পর্যন্ত কেবলমাত্র আমেরিকা যুক্তরাষ্ট্রের NAVSTAR গ্লোবাল পজিসনিং সিস্টেম এবং রাশিয়ার GLONASS গ্লোবাল পজিসনিং সিস্টেম-এর মাধ্যমে সমগ্র পৃথিবীর জি.এন.এস.এস. সংক্রান্ত কার্যকলাপ সম্পন্ন হত।

পরবর্তীকালে চিন (Beidou Navigation System) এবং ইউরোপ (Galileo Positioning System) ২০২০ সালে মধ্যে আঞ্চলিক জি.এন.এস.এস. স্থাপনের জন্য কার্যকরি ভূমিকা পালন করেছে। এছাড়া ফ্রান্স, জাপান, ভারতবর্ষ সহ নানান দেশ তাদের স্থানীয় পজিসিনিং ব্যবস্থা স্থাপনের জন্য গবেষণায়রত। এক্ষেত্রে মনে রাখা প্রয়োজন যে উপরে উল্লেখিত ব্যবস্থাগুলির তাদের কার্যকরী বজায় রাখে ২০-৩০টি উপগ্রহ (Medium Earth Orbit)-এর সমন্বয়ের সাপেক্ষে। এই উপগ্রহগুলি প্রায় ২০, ০০০ কি.মি. উপরে তাদের কক্ষপথে নিরন্তর প্রদক্ষিণরত। এই উপগ্রহগুলি তাদের কক্ষপথে পৃথিবীকে প্রদক্ষিণ করতে প্রায় ১২ ঘণ্টা সময় নেয়।

জি.এন.এস.এস.-এর প্রশাসনিক কাঠামো :

সম্মিলিত রাষ্ট্রপুঞ্জ (United Nations) মহাকাশ সম্বন্ধে অধ্যয়ন ও শান্তিপূর্ণভাবে পৃথিবীর মানুষের জন্য মহাকাশের ব্যবহারের উদ্দেশ্যে ২০০১ সালে একটি সম্মেলন আয়োজন করেন। সম্মিলিত রাষ্ট্রপুঞ্জ এই উদ্দেশ্যে একটা সংগঠন স্থাপন করেন; 'Committee on the Peaceful Uses of Outer space (COPUOS)। এই সংগঠনটির তত্ত্বাবধানে গ্লোবাল ন্যাভিগেশন স্যাটেলাইট সিস্টেম (জি.এন.এস.এস.) স্থাপনের জন্য একটা কার্যকরি দল তৈরি হয়। এই দলটির নেতৃত্ব দেওয়ার ক্ষেত্রে মূলত দুটি দেশ ছিল—আমেরিকা ও ইটালি। এই দলটি ৩৮টি রাষ্ট্র ও ১৫টি সংগঠন নিয়ে গঠিত হয়েছিল। এই দলটিকে বলা হল জি.এন.এস.এস.-এর কার্যকরি দল (Action team on GNSS)। এই কার্যকরি দল ২০০৫ সালে তার সুনির্দিষ্ট চিন্তাভাবনার বিস্তারের মাধ্যমে জি.এন.এস.এস.-কে কেন্দ্র করে সম্মিলিত রাষ্ট্রপুঞ্জের ছত্রছায়ায় একটা আন্তর্জাতিক সংগঠন স্থাপন করেন যা International Committee On GNSS (ICG) নামে পরিচিত। বস্তুত

*সহকারী অধ্যাপিকা, মহেশতলা কলেজ, কলকাতা-১৪১, ই-মেল : deepa.maheshtalacollege@gmail.com
**সহকারী অধ্যাপক, কুলতলী বি.আর. আবেদকর কলেজ, দঃ ২৪ পরগনা

RDas

DR. RUMPA DAS
Principal
Maheshtala College
Kolkata-7000139





MAHESHTALA COLLEGE

BUDGE BUDGE TRUNK ROAD, MAHESHTALA, KOLKATA – 700139
E-mail: maheshtalacollege@yahoo.com/ principal.maheshtalacollege@gmail.com
☎: 6289482452 (Office)
Website: www.maheshtalacollege.ac.in

Dr. Deepa Bhattacharjee, G.N.S.S. –er taty ebong khetro samikhai er proyog : ekti alochona, 2020

Proof of UGC approved journal: Bhugol Swadesh Charcha (Print only)

The screenshot shows a mobile browser interface with the URL ugccare.unipune.ac.in. The page title is "UGC-CARE List". The main content is a table titled "Journal Details" with the following entries:

Journal Title (in English Language)	Bhugol Swadesh Charcha (print only) (Current Table of Content)
Journal Title (in Regional Language)	ভূগোল স্বদেশ চর্চা (print only)
Publication Language	Bengali
Publisher	Bhugol Swadesh Charcha
ISSN	2581-4788
E-ISSN	NA
Discipline	Social Science
Subject	Social Sciences (all)
Focus Subject	Geogra Plannin Develo
UGC-CARE coverage	from 5 2019 to

Copyright © 2024 Savitribai Phule Pune University. All rights reserved. | Disclaimer

RDas

DR. RUMPA DAS
Principal
Maheshtala College
Kolkata-7000139





MAHESHTALA COLLEGE

BUDGE BUDGE TRUNK ROAD, MAHESHTALA, KOLKATA – 700139
E-mail: maheshtalacollege@yahoo.com/ principal.maheshtalacollege@gmail.com
☎: 6289482452 (Office)
Website: www.maheshtalacollege.ac.in

Annual Report (2022)

Number of research papers published per teacher in the Journals notified on UGC CARE list during the year 2022.

Number of published papers: 2

Title of Paper	Name of the author/s	Department	Name of journal	Calendar Year of publication	ISSN number	Link to article / paper / abstract of the article	Is it listed in UGC Care list
A generalized line segmentation method for multi-script handwritten text documents	Payel Rakshit	Computer Science	Expert Systems with Applications	2022	0957-4174	https://doi.org/10.1016/j.eswa.2022.118498	Yes
Comparative study on the performance of the state-of-the-art CNN models for handwritten Bangla character recognition	Payel Rakshit	Computer Science	Multimedia Tools and Applications	2022	1380-7501	https://doi.org/10.1007/s11042-022-13909-6	Yes

RDas

DR. RUMPA DAS
Principal
Maheshtala College
Kolkata-7000139





MAHESHTALA COLLEGE

BUDGE BUDGE TRUNK ROAD, MAHESHTALA, KOLKATA – 700139
E-mail: maheshtalacollege@yahoo.com/ principal.maheshtalacollege@gmail.com
☎: 6289482452 (Office)
Website: www.maheshtalacollege.ac.in

Name of the Author: Payel Rakshit, Assistant Professor, Maheshtala College

Web Link: <https://doi.org/10.1016/j.eswa.2022.118498>

Payel Rakshit, A generalized line segmentation method for multi-script handwritten text documents, 2022

Expert Systems With Applications 212 (2023) 118498



Contents lists available at ScienceDirect

Expert Systems With Applications

journal homepage: www.elsevier.com/locate/eswa



A generalized line segmentation method for multi-script handwritten text documents

Payel Rakshit^a, Chayan Halder^b, Md Obaidullah Sk^c, Kaushik Roy^{d,*}

^a Department of Computer Science, Maheshtala College, B.B.T. Road, Kolkata 141, WB, India

^b Department of Computer Science, Ramakrishna Mission Vivekananda Centenary College, Rahara, Kolkata 118, WB, India

^c Department of Computer Science and Engineering, Aliah University, Kolkata 156, WB, India

^d Department of Computer Science, West Bengal State University, Kolkata 126, WB, India

ARTICLE INFO

Keywords:

Unconstrained handwriting
Light projection
Start point detection
Boundary tracking
Text line segmentation
Filling and smoothing

ABSTRACT

Handwritten document image segmentation into text-lines is a crucial stage towards unconstrained handwritten document recognition. In the context of Indian subcontinent various scripts are used for communication where a system for multi-script handwritten text line segmentation is very much essential. This paper presents a multi-script text line segmentation algorithm based on newly developed light projection, start point detection, and boundary tracking methods. The proposed approach is capable of overcoming most of the hindrance faced by state-of-the-art methods. The experiment is performed on our proposed Bangla handwritten document image dataset WBSUBNdb_text and also on a variety of well-known public handwritten datasets namely: CMATERdb, PhDIndic_11, KHATT, HIT-MW, ISI Bengali Writer Identification/Verification datasets, ICDAR 2013 segmentation contest dataset, ICDAR 2013 writer identification contest benchmark dataset, and obtained promising results.

1. Introduction

Text Line Segmentation is not only one of the most crucial pre-processing steps of OCR but also essential for tasks like the alignment of text/image, extraction of specific fields, word spotting (Jamuna & Haribabu, 2015), handwriting analysis (Halder et al., 2018; Mukherjee et al., 2019; Vidushi & Agarwal, 2021), etc. Some of the systems follow analytic approach where the unit of recognition is character and for such systems line segmentation is an immensely important stage that needs to be followed. 'Line' is a basic entity of text document image and segmentation of line is treated as one of the most significant tasks of handwritten OCR. Thus, it is very clear that line segmentation is an unavoidable step for document image processing. Text line segmentation of machine printed documents is quite a solved problem but the same task is still challenging for handwritten documents. The wide variations of handwritten text make the segmentation task more challenging. The major difficulties include high variation in writing styles, irregular line gap, skew angle between text lines, variable character size, and overlapping or touching lines. In different languages (e.g. Arabic, Greek, French, Bangla, Urdu, etc.), plethora of accents make their presence frequently, this intern incorporates more hurdles for line segmentation. To top it all, the irregular and diverse nature of

handwritten documents are dependent on writers which increases the level of difficulty to a great extent. Many researchers have put their contribution to solve this problem of text line segmentation in freestyle environment (Likforman-Sulem & Faure, 1994; Rakshit et al., 2018). There are already some conventional approaches like projection profile (Babczyński & Ptak, 2020), Hough transform (Louloudis et al., 2009; Pu & Shi, 1999); Smearing and grouping of components etc. (Gatos et al., 2007; Shi & Govindaraju, 2004); but these methods become inadequate to handle all types of documents when they are applied individually. Sometimes the combination of some conventional methods show more effectiveness than an individual one which is quite evident in the literature (Rakshit et al., 2018; Sanasam et al., 2020; Sarkar et al., 2009; Stamatopoulos et al., 2013). In this work, an attempt has been made towards an efficient yet less complex line segmentation system capable of handling diverse handwritten documents. Distinguishing of foreground and background pixel or text and non text area is a very common step towards text line segmentation to make the task easier. In the proposed system, isolating the text and non-text regions of a document is done using a novel light projection method. It uses the properties of light where text components are considered as objects. Following the same properties, whenever light gets a text pixel as an obstacle in its path,

* Corresponding author.

E-mail addresses: prmylife20@gmail.com (P. Rakshit), chayan.halderz@gmail.com (C. Halder), sk.obaidullah@gmail.com (M.O. Sk), kaushik.mrg@gmail.com (K. Roy).

<https://doi.org/10.1016/j.eswa.2022.118498>

Received 5 March 2021; Received in revised form 25 October 2021; Accepted 8 August 2022

Available online 23 August 2022

0957-4174/© 2022 Elsevier Ltd. All rights reserved.

RDas

DR. RUMPA DAS
Principal
Maheshtala College
Kolkata-7000139





MAHESHTALA COLLEGE

BUDGE BUDGE TRUNK ROAD, MAHESHTALA, KOLKATA – 700139
E-mail: maheshtalacollege@yahoo.com/ principal.maheshtalacollege@gmail.com
☎: 6289482452 (Office)
Website: www.maheshtalacollege.ac.in

Payel Rakshit, A generalized line segmentation method for multi-script handwritten text documents, 2022

Proof of UGC approved journal: Expert Systems with Applications

https://mjl.clarivate.com/journal-profile

Journal List Search Journals Match Manuscript Downloads Help Center

Check out our new metric to help you evaluate journals! Dismiss Learn More

EXPERT SYSTEMS WITH APPLICATIONS Share This Journal

ISSN / eISSN 0957-4174 / 1873-6793
Publisher PERGAMON-ELSEVIER SCIENCE LTD, THE BOULEVARD, LANGFORD LANE, KIDLINGTON, OXFORD, ENGLAND, OX5 1GB

General Information

Journal Website	Visit Site	Publisher Website	Visit Site
1st Year Published	1990	Frequency	Semi-monthly
Issues Per Year	24	Country / Region	UNITED STATES OF AMERICA
Primary Language	English		

Return to Search Results

Web of Science Coverage

Collection	Index	Category	Similar Journals
Core Collection	Science Citation Index Expanded (SCIE)	Computer Science, Artificial Intelligence Operations Research & Management Science Engineering, Electrical & Electronic	Find Similar Journals
Current Contents	Engineering, Computing & Technology	AI, Robotics, And Automatic Control	Find Similar Journals
Other	Essential Science Indicators	Engineering	Find Similar Journals

RDas

DR. RUMPA DAS
Principal
Maheshtala College
Kolkata-7000139





MAHESHTALA COLLEGE

BUDGE BUDGE TRUNK ROAD, MAHESHTALA, KOLKATA – 700139
E-mail: maheshtalacollege@yahoo.com/ principal.maheshtalacollege@gmail.com
☎: 6289482452 (Office)
Website: www.maheshtalacollege.ac.in

Name of the Author: Payel Rakshit, Assistant Professor, Maheshtala College

Web Link: <https://doi.org/10.1007/s11042-022-13909-6>

Payel Rakshit, Comparative study on the performance of the state-of-the-art CNN models for handwritten Bangla character recognition, 2022

Multimedia Tools and Applications
<https://doi.org/10.1007/s11042-022-13909-6>



Comparative study on the performance of the state-of-the-art CNN models for handwritten Bangla character recognition

Payel Rakshit¹ · Somnath Chatterjee² · Chayan Halder³ · Shibaprasad Sen⁴ · Sk Md Obaidullah⁵ · Kaushik Roy⁶ 

Received: 6 February 2022 / Revised: 17 May 2022 / Accepted: 12 September 2022
© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2022

Abstract

In the realm of Optical Character Recognition, handwritten character recognition in Bangla is still an unresolved challenge. There have been many breakthroughs in object recognition technology; however, the present approaches may not necessarily give good results for such problems. In this paper, a set of recently developed popular Convolutional Neural Networks (CNNs) is discussed with their application on Bangla handwritten character recognition for the standard dataset 'Ekush' and the performance of each of the CNN networks is systematically evaluated. It is obvious that the CNN approaches are more effective than traditional approaches because of their ability to generate discriminative features from raw data. The current study shows the superior performance of CNN models with their recognition rate; which in turn implies that CNN networks are practically suitable to build an automatic Bangla handwritten character recognition system.

Keywords Deep learning · Bangla handwriting recognition · CNN · Ekush dataset

1 Introduction

Handwritten character recognition is not only considered to be one of the most appealing and challenging research domains in the field of pattern recognition but also continuously expanding the area of computer vision. It has become an important and broadly used technology as it provides more ease of use to computer users. Some popular real-world applications of the character recognition system include document classification [14], question-answering [76], information extraction [21] etc. Character recognition is the process where detection and recognition of the characters are performed by a machine and the processed data is converted into a code that is understandable by the machine. The task of recognition becomes difficult and time-consuming because of writing variations of individual characters, cursive text, and the similarities in distinct character shapes. But

✉ Kaushik Roy
kaushik.mrg@gmail.com

Extended author information available on the last page of the article.

Published online: 02 November 2022

 Springer



DR. RUMPA DAS
Principal
Maheshtala College
Kolkata-7000139





MAHESHTALA COLLEGE

BUDGE BUDGE TRUNK ROAD, MAHESHTALA, KOLKATA – 700139
E-mail: maheshtalacollege@yahoo.com/ principal.maheshtalacollege@gmail.com
☎: 6289482452 (Office)
Website: www.maheshtalacollege.ac.in

Payel Rakshit, Comparative study on the performance of the state-of-the-art CNN models for handwritten Bangla character recognition, 2022

Proof of UGC approved journal: Multimedia Tools and Applications

https://mjl.clarivate.com/journal-profile

al List Search Journals Match Manuscript Downloads Help Center

Check out our new metric to help you evaluate journals! Dismiss Learn More

MULTIMEDIA TOOLS AND APPLICATIONS

ISSN / eISSN 1380-7501 / 1573-7721
Publisher SPRINGER, VAN GODEWIJCKSTRAAT 30, DORDRECHT, NETHERLANDS, 3311 GZ

General Information

Journal Website	Visit Site	Publisher Website	Visit Site
1st Year Published	1995	Frequency	Monthly
Issues Per Year	12	Country / Region	NETHERLANDS
Primary Language	English		

Web of Science Coverage

Collection	Index	Category	Similar Journals
Core Collection	Science Citation Index Expanded (SCIE)	Computer Science, Software Engineering Computer Science, Theory & Methods Engineering, Electrical & Electronic Computer Science, Information Systems	Find Similar Journals
	Engineering, Computing & Technology	Computer Science & Engineering	Find Similar Journals
Other	Essential Science Indicators	Computer Science	Find Similar Journals

R Das

DR. RUMPA DAS
Principal
Maheshtala College
Kolkata-7000139

