

# Resume of Dr. Md Mojahidul Islam

## Personal Information

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Name: **Dr. Md Mojahidul Islam**

Date of Birth: 07<sup>th</sup> Oct, 1982

Birth Place: Bangladesh, Bangladesh

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Address: Dept. of Computer Science & Engineering, Islamic University, Kushtia-7003, Bangladesh

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## Career Objective

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To advance research in Computer Science and Engineering through innovative studies in Biomedical Signal and Image Processing, aiming to develop intelligent computational models for accurate disease diagnosis and medical data interpretation. My goal is to contribute to the integration of engineering principles and biomedical science, promoting interdisciplinary research that enhances healthcare technology and clinical decision-making.

## Skills & Background Knowledge

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**Programming Language:** C, C++, Java, Python, Visual Basic, Visual C++, Python, Matlab, HTML, CSS, PHP, JSP, C# .NET etc.

**Deep Learning Tools:** Caffe, Pytorch, TensorFlow, Keras, Pandas, Numpy, Scipy, OpenCV etc.

**Software Tools:** MS Office, Laravel, Adobe Photoshop, Adobe Illustrator, SQL Server, Oracle, MySql, Mobile App Development, Node Js, Cisco Packet Tracer etc.

## Educational Background

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**Doctor of Philosophy (PhD) in Computer Science & Engineering,**

*Faculty of Engineering and Technology, Islamic University, Kushtia-7003, Bangladesh.*

Year of Award: 2024

**Master of Science (MSc) in Computer Science & Engineering,**

*Faculty of Engineering and Technology, Islamic University, Kushtia-7003, Bangladesh.*

**Result:** First Class, (1<sup>st</sup> position in the order of merit)

**Thesis:** *Handwritten Character Recognition System of Bangla text Containing Modifier and Overlapped Characters.*

Year of Award: **November 2007 (Held in 2005)**

**Bachelor of Science (BSc) in Computer Science & Engineering**

*Faculty of Engineering and Technology, Islamic University, kushtia-7003, Bangladesh.*

**Result:** First Class, (1<sup>st</sup> position in the order of merit) **Project:**

*Moving Message over Dot Matrix Display.*

Year of Award: **March 2006 (Held in 2003)**

**Higher Secondary Certificate (HSC)**

*Satkhira Govt. College, Jessore Board, Bangladesh.*

**Result:** First Division

**August 1999.**

**Secondary School Certificate (SSC)**

*D.B United High School, Jessore Board, Bangladesh.*

**Result:** First Division

**July 1997.**

## Professional/Teaching Experiences

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- a) Duration: 2024–Present, **Professor**, *Department of Computer Science & Engineering, Faculty of Engineering and Technology, Islamic University, Kushtia-7003, Bangladesh.*
- b) Duration: 2019–2024, **Associate Professor**, *Department of Computer Science & Engineering, Faculty of Engineering and Technology, Islamic University, Kushtia-7003, Bangladesh.*
- c) Duration: 2012–2019, **Assistant Professor**, *Department of Computer Science & Engineering, Faculty of Engineering and Technology, Islamic University, Kushtia-7003, Bangladesh.*
- d) Duration: 2010–2012, **Lecturer**, *Department of Computer Science & Engineering, Faculty of Engineering and Technology, Islamic University, Kushtia-7003, Bangladesh.*
- e) Duration: 2009–2010, **Scientific Officer**, *Bangladesh Atomic Energy Commission, Dhaka, Bangladesh.*
- f) Duration: 2008–2009, **Lecturer**, *Department of Computer Science and Engineering University of Information Technology & Sciences, Dhaka, Bangladesh.*
- g) Duration: 2007–2008, **Software Engineer**, *IT Bangla Limited, Dhaka, Bangladesh.*

## Taught Courses

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- Internet and Web Programming
- Computer Fundamentals
- Digital Signal and Image Processing
- Microprocessor & Assembly Language Programming
- Data Communication and Computer Network
- Database Management System

- Computer Architecture and Organization
- Data Structure and Algorithms
- Advanced Wireless and Mobile Communications
- Cloud Computing
- Operating Systems
- Computer Programming

## Research Experiences

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**1. Member, Duration: 2024-2025,** *Enhancing Digital Government and Economy (EDGE)* is a project of the Bangladesh Computer Council (BCC) under the ICT Division.

**2. Project Director, Duration: 2023-2024,** *Bangladesh University Grant Commission (UGC) Funded project on Plant Diseases Recognition using U-Net Based Deep Learning.*

**3. Project Director, Duration: 2022-2023,** *Bangladesh University Grant Commission (UGC) Funded project on Automatic Missile Tracking System in Defense.*

**4. Project Director, Duration: 2020-2021,** *UGC Funded Islamic University Project on RGB-D Sensor Camera Based Obstacle Segmentation and Warning System for Blind and Visually Impaired People.*

## Publications

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1. Md. Shakhawat Hosen, Samiul Basir, Md. Farukuzzaman Khan, A.O.M Asaduzzaman, · **Md. Mojahidul Islam**, Md Shohidul Islam: “Supervised single-channel dual domains speech enhancement technique using bidirectional long short-term memory”, *Multimedia Tools and Applications*, November 2024. (SCIE, IF=3.0)
2. Md. Nahid Hossain, Samiul Basir, Md. Shakhawat Hosen, A.O.M. Asaduzzaman, **Md. Mojahidul Islam**, Mohammad Alamgir Hossain, and Md Shohidul Islam: “Supervised Single Channel Speech Enhancement Method Using UNET”, in *Electronics*, vol. 12, no. 14, July 2023. (SCIE, IF=2.6)
3. Md. Atiqur Rahman, Mohammad Alamgir Hossain, Md. Ibrahim Abdullah, Ahsan-Ul-ambia, **Md. Mojahidul Islam**, Md. Shohidul Islam: “An In-Depth study is conducted on the segmented Genes of the Cancer-Causing Helicobacter pylori”, in *IITM Journal of Management and IT*, vol. 13, no. 2, pp. 74-86, July-December 2022.
4. Md. Imran Hossain, **Md. Mojahidul Islam**, Tania Nahrin, Md. Rashed, Md. Atiqur Rahman: “Improving Speech Emotion Recognition and Classification Accuracy Using Hybrid CNN-LSTM-KNN Model”, in *International Journal of Research Publication and Reviews*, vol. 5, no. 8, pp. 4164-4173, August 2024

5. Sanjida Ara Mousumi, A. O. M. Asaduzzaman, **Md. Mojahidul Islam**, M. Robiul Hoque: "Context-Aware Tourist Guide: A Rule based Approach", in *International Journal of Advanced Networking and Applications* , vol 16, no. 1 (2024), pp. 6270-6274, July 2024.
6. **Md Mojahidul Islam**, Guoqing Hu and Qianbo Liu, Wang Dan and Chengzhi Lyu: "Correlation Filter Based Moving Object Tracking with Scale Adaptation and Online Re-Detection", in *IEEE Access*, vol. 6, pp. 75244-75258, November 2018. (SCIE, IF=3.6)
7. **Md Mojahidul Islam**, Guoqing Hu and Qianbo Liu: "Online Model Updating and Dynamic Learning Rate-Based Robust Object Tracking", in *Sensors*, vol. 18, no. 7, June 2018. (SCIE, IF=3.4)
8. **Md. Mojahidul Islam**, Md. Robiul Hoque, Md. Atiqur Rahman, Md. Imran Hossain: "Obstacle Segmentation And Warning System For Visually Impaired People", in *International Journal Of Advance Research And Innovative Ideas In Education*, Vol. 10, no. 3 (2024), pp. 4750-4760, May 2024
9. **Md. Mojahidul Islam**, Ahsan-Ul-Ambia, A.O.M Asaduzzaman, Md. Shohidul Islam, Md. Atiqur Rahman: "Object Defect Detection Using Histogram Analysis and Spearman's Correlation Coefficient", in *International Journal of Research and Scientific Innovation*, vol. 11, no. 4, pp. 137-142, April 2024
10. Wang Dan, Guoqing Hu and Qianbo Liu, Chengzhi Lyu and **Md Mojahidul Islam**: "Region-Based Nonparametric Model for Interactive Image Segmentation", in *IEEE Access*, vol. 7, pp. 111124 - 111134, August 2019. (SCIE, IF=3.6)
11. Qianbo Liu, Guoqing Hu and **Md Mojahidul Islam**: "Robust Visual Tracking With Spatial Regularization Kernelized Correlation Filter Constrained by a Learning Spatial Reliability Map", in *IEEE Access*, vol. 7, pp. 27339 - 27351, February 2019. (SCIE, IF=3.6)
12. Qianbo Liu, Guoqing Hu and **Md Mojahidul Islam**: "Fast Visual Tracking With Robustifying Kernelized Correlation Filters", in *IEEE Access*, vol. 6, pp. 43302 - 43314, July 2018. (SCIE, IF=3.5)
13. Nur Hossain Khan, Md. Farukuzzaman Khan, **Md. Mojahidul Islam**, Md. Habibur Rahman & Bappa Sarker "Verification of Bangla Sentence Structure using N-Gram", *Global Journal of Computer Science and Technology: A Hardware and Computation*, vol. 14, no. 1, 2014.
14. **Md. Mojahidul Islam** and Md. Ibrahim Abdullah: "SMS banking using Cell phone", *International Journal of Innovation and Applied Studies*, Vol. 3 No. 2, pp. 463-469 June 2013.
15. **Md. Mojahidul Islam**, Md. Aktaruzzamn, Md. Farukuzzaman, Md. Shohidul Islam: "Handwritten Character Segmentation System For Bangla Text Containing Modifier And Overlapped Characters", *Journal of Asian Transactions on Computers (ATC-30126054)*, Volume 01 Issue 05(November 2011).
16. **Md. Mojahidul Islam**, M. Imran Hossain & M. Kislu Noman: "Bangla Character Recognition System is Developed by using Automatic Feature Extraction and XOR Operation", *Global Journal of Computer Science and Technology Graphics & Vision*, Volume 13 Issue 2 Year 2013.
17. M. Shohidul Islam, M. Babul Islam, **M. Mojahidul Islam**, M. Shamim Hossain, M. Muntasir Rahman: "Comparative study between Mel-LP and LP-Mel based front-

ends for noisy speech recognition using HMM”, *Journal of Asian Transactions on Computers* (ATC ISSN: 2221-4275), Volume 01 Issue 02(April 2011).

18. Md. Imran Hossain, Md. Kislu Noman, **Md. Mojahidul Islam**, Md. Mursalin: “Specific face detection from large number of stored faces”, *International Journal of Scientific & Engineering Research*, Volume 4, Issue 5, May-2013 .
19. Md. Imran Hossain, Md. Kislu Noman, **Md. Mojahidul Islam** & Md. Rashedul Islam: “Performance Analysis of CDMA System using Direct Sequence Spread Spectrum and Frequency Hopping Spread Spectrum Techniques”, *Global Journal of Computer Science and Technology Network, Web & Security*, Volume 13 Issue 6 Year 2013.
20. Md. Kislu Noman, **Md. Mojahidul Islam**, Md. Shafiul Azam, Nur Hossain Khan : “Comparative study between Selection Mapping Technique (SLM) and Partial Transmission Sequence (PTS) for PAPR reduction in OFDM signals”, *International Journal of Advanced Research in Computer and Communication Engineering*, Vol. 2, Issue 11, November 2013.
21. Md. Kazi Salimullah, Md. Khalilur Rahman, **Md. Mojahidul Islam**: “The fundamental formulas for vertices of convex hull”, *American Journal of Engineering Research (AJER)*, Volume-02, Issue-07, July 2013.

## Declaration

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I hereby declare that the information given above is true to the best of my knowledge. I will make it my earnest endeavour to discharge competently and carefully the duties you may be pleased to entrust me.



**(Dr. Md Mojahidul Islam)**

Place: Dept. of Computer Science & Engineering,  
Islamic University, Kushtia-7003, Bangladesh

Date: February, 2025

## Article

# Online Model Updating and Dynamic Learning Rate-Based Robust Object Tracking

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**Abstract:** Robust visual tracking is a significant and challenging issue in computer vision-related research fields and has attracted an immense amount of attention from researchers. Due to various practical applications, many studies have been done that have introduced numerous algorithms. It is considered to be a challenging problem due to the unpredictability of various real-time situations, such as illumination variations, occlusion, fast motion, deformation, and scale variation, even though we only know the initial target position. To address these matters, we used a kernelized-correlation-filter-based translation filter with the integration of multiple features such as histogram of oriented gradients (HOG) and color attributes. These powerful features are useful to differentiate the target from the surrounding background and are effective for motion blur and illumination variations. To minimize the scale variation problem, we designed a correlation-filter-based scale filter. The proposed adaptive model's updating and dynamic learning rate strategies based on a peak-to-sidelobe ratio effectively reduce model-drifting problems by avoiding noisy appearance changes. The experiment results show that our method provides the best performance compared to other methods, with a distance precision score of 79.9%, overlap success score of 59.0%, and an average running speed of 74 frames per second on the object tracking benchmark (OTB-2015).

**Keywords:** object tracking; machine learning; correlation filter; occlusion detection; scale adaptation; online model updating; dynamic learning rate

## 1. Introduction

Robust visual object tracking has been an effective research subject in computer vision in the current decades. Techniques for visual object tracking are not only involved in practical applications, including face tracking [1,2], traffic analysis [3,4], and human–computer interaction [5,6], but are also applied to different video processing methods. The common strategy of visual tracking is to identify the target object by a bounding box over consecutive frames, where an initial target position is set in the start frame. Due to the practical applications of visual tracking, many research works have been performed and different strategies have been proposed [1–6]. Although single-object tracking is a well-researched topic and has achieved great improvements over the past decades, it remains a challenging problem to design efficient and robust trackers that can handle all challenging situations, such as deformation, abrupt motion change, partial occlusion, full occlusion, cluttered backgrounds, illumination changes, and large variations in the viewpoint and pose of the target.

Most of the object tracking techniques are categorized into two approaches—generative and discriminative. Generative tracking methods train the target object without considering the surrounding background information. This approach can control the partial missing data that

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# Correlation Filter Based Moving Object Tracking With Scale Adaptation and Online Re-Detection

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**ABSTRACT** Object tracking is a difficult work in complex situations including crowded environment, occlusion, out of view, and fast motion. Recently, many tracking strategies have been designed to handle the object tracking in complex conditions. However, most of the designed methods are inefficient to tackle the target aspect ratio variation and disappearance problems during the long-term tracking. Hence, it is most important to design a tracking algorithm that effectively reduce the drifting problem and recapture the target from the tracking failure. In this paper, we proposed a robust correlation filter-based moving object tracker with scale adaptation and online re-detection. First, we trained a translation filter using kernelized correlation filter with the multiple features for identifying the initial target location in each frame. Second, we used the high confidence score of the correlation output to reduce the model-drifting problem. Third, we introduced a new online re-detection strategy to relocate the target at the time of tracking failure. This re-detection component activated dynamically based on the present and historical confidence scores of the target. To tackle the aspect ratio and scale variation problems, we used detection proposal with the correlation filter method. The experimental evaluation on the several benchmark datasets proved that our results significantly better compared with the other methods.

**INDEX TERMS** Moving object tracking, correlation filter, object detection proposal, scale adaptation, online re-detection.

## I. INTRODUCTION

Visual target tracking is the challenge of estimating an unknown position and size of the target object throughout the video sequences, where the target location specified in the first frame. Object tracking is useful in various real life applications such as robotics, video surveillance system, human computer interaction, traffic management system, missile tracking and automated car driven system [1]–[7]. Over the past ten years, noticeable progress have been accomplished in visual object tracking study and most of the visual tracking works in simple conditions were solved well, as surveyed in [8] and [9]. Even though the recent improvements in visual tracking performance, the technical improvement of the present object tracking system cannot obtain the real human visual system perfection. Hence, the present object tracking methods have more scope for improvement. The moving target tracking is complicated because of the object appearance variations and its surrounding background, as well as different complicated situations

including scale variation, occlusion, out of view, deformation, rotation and fast motion. Current visual tracking methods are categorized as either generative or discriminative. Generative tracking algorithms locate the target object by building a robust target appearance model and finding the best region to match the target model. For example, sparse representation tracking [10]–[12], compressive tracking [13] and incremental Log-Euclidean subspace learning [14]. In contrast with the generative trackers, discriminative trackers locate the target by constructing an object model and background model, and distinguish the target from the neighboring background by discriminative classifier [15]–[20]. Avidan [15] used Support Vector Machine as a binary classifier to separate the object from the neighboring background. Hare *et al.* [19] proposed a new method for visual tracking by using support vector machine. Babenko *et al.* [16] handle the obscurity difficulty in the training samples by using Multiple Instance Learning. These tracking approaches also called tracking

# Region-Based Nonparametric Model for Interactive Image Segmentation

DAN WANG<sup>✉</sup>, GUOQING HU, QIANBO LIU<sup>✉</sup>, CHENGZHI LYU, AND MD MOJAHIDUL ISLAM<sup>✉</sup>

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Corresponding author: Guoqing Hu (gqhu@scut.edu.cn)

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**ABSTRACT** In this paper, we present a novel framework for interactive segmentation problems. It integrates a nonparametric model into the Conditional Random Field (CRF) framework, which can effectively combine high-level features with low-level features to represent image information. In the nonparametric model, multiple region layers are used to estimate data likelihood terms to overcome the bad regions generated by unsupervised methods. The likelihood values of each layer are calculated separately to reduce the computational cost. In addition, we analyze that the pixel layer has little effect on data estimation, so we remove it to further reduce the complexity of the algorithm. We employ the label consistency between pixels and their corresponding regions in smooth term estimation, which can be regarded as a higher order potential for pixels. The data term and the smooth term are then performed together in Conditional Random Fields (CRFs) as a fine-tuning of the results. Experimental results show that the proposed method can segment images efficiently and accurately with fewer user inputs.

**INDEX TERMS** Higher order CRFs, interactive segmentation, region-based model, nonparametric model.

## I. INTRODUCTION

Image segmentation is a fundamental task in computer vision and has obtained much attention in recent decades. It can be viewed as a labeling problem that assigning each pixel in the image a predefined label based on its color, intensity and other features. The challenge in segmentation problems is that the boundaries and appearance of natural images are often complex. In these years, various interactive segmentation algorithms have had significant success due to their ability to improve the performance by incorporating user interactions to the segmentation models, such as graph cut [1]–[3], lazy snapping [4], [5], random walker [6]–[8], geodesic segmentation [9], shortest path [10], [11], and deep convolutional networks [12], [13]. In interactive methods, users are allowed to provide a few strokes [1] or a bounding box [14] as initial labels which can help to improve the segmentation results. The primary goal is to extract object boundaries or regions with as little user interaction as possible [15].

CRF framework has been the most widely used framework for segmentation problems. It explicitly models the relationship between pixels and minimizes the energy function defined based on pixels intensities. The basic form of

the energy function in CRF framework is to combine data terms with smooth terms. The data term is typically the unary potential obtained from a classifier. Thus, the segmentation performance is heavily influenced by the classifier. Parametric models are widely used as classifiers for data term estimation. Model parameters are treated as variables and optimized together with the energy function [15]. However, parametric models require a large numbers of initial inputs to get accurate segmentation results, most of which are strongly sensitive to the seed quantity and placement. The commonly used smooth term is the pairwise potential which encourages the nearby pixels to have the same label if their intensities are similar. Although pairwise models can be inferred efficiently, they are very limited to express complicated energy formulations as they can only propagate information to the pixels in the local neighborhoods [16]. They are unable to model high-level features which have been shown to be significant powerful for segmentations.

To overcome this problem, [16] proposed higher order potentials to capture high-level structural information of the images. Their algorithms were built on the image regions which had been generated by unsupervised methods. They encouraged the pixels in a region to have the same label. [17] combined a semi-supervised learning technique and region-based models together. They first

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# Robust Visual Tracking With Spatial Regularization Kernelized Correlation Filter Constrained by a Learning Spatial Reliability Map

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**ABSTRACT** As a basic research topic in computer vision, visual tracking is still challenging because of the complexity of the tracking problems, such as abrupt motion, out-of-view, deformation, and heavy occlusion. In this paper, we extend the kernelized correlation filter (CF) for robust tracking by introducing spatial regularization components to penalize the CF coefficients. To afford a more confident prediction, we construct a spatial reliability map based on the color histogram to enforce the detecting samples near the target center. The feature fusion and the model update mechanism are further employed to improve the effectiveness of tracking. The extensive experiments are executed on the OTB-2013, OTB-2015, and Temple Color-128 datasets. The comprehensive results demonstrate the superiority of our proposed method comparing to the representative tracks on these datasets.

**INDEX TERMS** Feature fusion, model update mechanism, spatial regularization components, spatial reliability map.

## I. INTRODUCTION

robust visual object tracking is an attractive research problem in the field of computer vision. Which serves wide applications including human-computer interaction, video surveillance, robotics, autonomous driving, etc [1]. A generic scenario of visual object tracking is to estimate the trajectory of target throughout an image sequence, given an initial location of the target in the first frame. Although the considerable progresses have been made in recent years, the task of visual tracking remains to be very challenging due to the appearance changes of the target in real-world phenomena, such as deformation, occlusion, illumination, background clusters, scale variation and so on.

Generally, an appearance model of the target which was obtained by either generative-based [2]–[6] or discriminative-based [7]–[10] methods is first trained in most existing trackers, then the learned appearance model is utilized to estimate the states of the target in a new frame. With the new training data cropped from the prediction of the tracker, the model

is updated online. However, as the large appearance changes of the target throughout an image sequence, the accumulated error in the online model can lead to failure in tracking. The key challenge in visual object tracking is that the tracker should deal with the changes of the appearance under strong robustness, that is to say, the appearance model of target should be updated online accurately and adaptively.

Recently, discriminative correlation filter (CF)-based methods ([10]–[17]) have been popular in terms of their excellent performance. These methods train a correlation filter using a set of training samples with features as raw pixels, color names or histogram of oriented gradients (HOG). Although considerable results have been achieved in accuracy and robustness, the limitation of each feature may lead to the tracking failure in some certain scenes for the complex conditions. Even multiple features fusion in several methods [10], [11] have been exploited to learn the appearance model, the trackers prone to drift due to heavy occlusion and fast motion. In addition, several algorithms with the representations in deep features ([18]–[21]) enhance performance at cost of the much computational burden, which is unsuitable for real-world applications.

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