





Vol. 15/ No. 57/Autumn 2025

Research Article

Velocity and Direction-Based Motion Estimation in Video Compression to Reduce Computation and Increase Video Quality

Dadvar Hosseini Avashanagh, Ph.D. Student ¹  | Mehdi Nooshyar, Associate Professor ²  | Saeed Barghandan, Assistant Professor ³  | Majid Ghandchi, Assistant Professor ⁴ 

¹Ph.D. Student, Department of Electrical Engineering, Islamic Azad University, Ahar Branch, Ahar, Iran, dadvarhosseini@gmail.com

²Associate Professor, Department of Electrical and Computer Engineering, University of Mohaghegh Ardabili, Ardabil, Iran, nooshyar@uma.ac.ir

³Assistant Professor, Department of Electrical Engineering, Islamic Azad University, Ahar Branch, Ahar, Iran, saeed_barghandan@yahoo.com

⁴Assistant Professor, Department of Electrical Engineering, Islamic Azad University, Ahar Branch, Ahar, Iran, majid.ghandchi@iau.ac.ir

Correspondence

Mehdi Nooshyar, Associate Professor of Electrical and Computer Engineering, University of Mohaghegh, Ardabil, Iran
Email: nooshyar@uma.ac.ir

Received: 29 August 2024

Revised: 11 October 2024

Accepted: 14 October 2024

Abstract

High-Efficiency Video Coding (HEVC) is the latest video coding standard. This standard supports high-definition (HD) videos by providing double the compression efficiency compared to the H.264 standard. The motion estimation computations in HEVC are the most complex part of video coding, consuming most of the encoding time. Numerous methods have been proposed to reduce the motion estimation time, many of which have proven effective in practice. Despite implementing efficient algorithms for motion estimation, the processing time remains significantly high compared to real-time requirements. This research proposes a fast sub-pixel motion estimation algorithm with fewer search points for video coding. The proposed method is based on a mathematical model of motion physics and image features in consecutive frames, utilizing statistical information about the motion of elements in video sequence frames. This algorithm reduces computational complexity by decreasing the number of search points and improving relative video quality parameters.

Keywords: Compression, HEVC, motion estimation, Pixels, video coding.

Highlights

- Reducing the number of search points in video motion estimation.
- Reducing the complexity of motion estimation calculations.
- Increasing the speed of motion estimation calculations.
- Increasing the quality of the final image and video: This increase in quality in terms of psnr-hvs and pevq-mos made the image better from the point of view of human vision.

Citation: [in Persian].