# Real-Time Smoke Detection in Video Based on Two-Step Selection of Regions of Interest and Directional Movement Analysis

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- <u>Shiping Ye</u>,
- <u>Y. Adamovsky</u>,
- <u>Huafeng Chen</u>,
- <u>R. Bohush</u> &
- <u>S. Ablameyko</u>

## Abstract

An algorithm for early detection of light smoke in image sequences has been developed, which enables processing of high-resolution video in real time. To do this, preliminary areas of interest that may contain smoke are identified based on motion detection, its spatiotemporal analysis, and color segmentation in HSV space. Then, the calculation of the parameters of high-frequency components is applied for these areas using a two-dimensional wavelet transform and contrast on video frames relative to the background model. This approach makes it possible to identify regions where smoke obscures background elements. The result of this stage is refined areas of interest. The final step is to estimate the direction of movement in the identified areas using the optical flow method, taking into account the analysis of changes in movement vectors over time. The algorithm is implemented using the OpenCV computer vision library in C++. Software has been developed for automated marking of video data and calculation of detection metrics. The results of experimental studies on the assessment of the accuracy and speed of the algorithm are demonstrated, and a comparison of its effectiveness with existing ones is presented.

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## Funding

## Author information

### Authors and Affiliations

1. **Zhejiang Shuren University, 310015, Hangzhou, China**

Shiping Ye & Huafeng Chen
2. **International Science and Technology Cooperation Base of Zhejiang Province: Remote Sensing Image Processing and Application, 310000, Hangzhou, China**
Shiping Ye & Huafeng Chen
3. **Polotsk State University, 211440, Novopolotsk, Belarus**
Y. Adamovsky & R. Bohush
4. **Belarusian State University, 220030, Minsk, Belarus**
S. Ablameyko
5. **United Institute for Informatics Problems, National Academy of Sciences of Belarus, 220012, Minsk, Belarus**
S. Ablameyko

## Corresponding authors

Correspondence to <u>Shiping Ye</u>, <u>Y. Adamovsky</u>, <u>Huafeng Chen</u>, <u>R. Bohush</u> or <u>S. Ablameyko</u>.

## Ethics declarations

The authors of this work declare that they have no conflicts of interest.

## Additional information

**Shiping Ye**. Born in 1967. Professor and Vice President of Zhejiang Shuren University. Graduated from Zhejiang University in 1988. He received his master's degree in Computer Science and Technology from Zhejiang University in 2003. His scientific interests include the application of computer graphics and images, GIS. Author of more than 70 scientific articles. He has taken part in four research projects and was awarded second prize of Zhejiang Provincial Scientific and Technological Achievement. Two of his teaching research programs won the first prize and second prize of Zhejiang Provincial Teaching Achievement.

**Huafeng Chen**. Born in 1982. Professor of Zhejiang Shuren University. Graduated from Zhejiang University in 2003. In 2009 he got his PhD in the field of Earth Exploration and Information Technology at the Institute of Space Information & Technique, Zhejiang University. His scientific interests include remote sensing image processing, GIS application, image and video processing, multiagent system. He has published more than 40 academic articles.

**Rykhard Bohush**. Graduated from Polotsk State University in 1997. In 2002, he received his Candidate of Sciences degree, and in 2022, he received his Doctor of Sciences degree. Head of Computer Systems and Networks Department of Polotsk State University. His scientific interests include intelligent and cognitive systems, machine learning, computer vision, and image processing.

**Sergey Ablameyko**. Born in 1956, DipMath in 1978, PhD in 1984, DSc in 1990, Prof. in 1992. Professor at Belarusian State University. His scientific interests are image analysis, pattern recognition, digital geometry, knowledge-based systems, geographical information systems, medical imaging. He is on the Editorial Board of *Pattern Recognition and Image Analysis* and many other international and national journals. He is a Fellow of IAPR, Fellow of Belarusian Engineering Academy, Academician of National Academy of Sciences of Belarus, Academician of the European Academy,etc. He was First Vice-President of International Association for Pattern Recognition IAPR (2006–2008), President of Belarusian Association for Image Analysis and Recognition.

**Yahor Adamovskiy** graduated from Polotsk State University in 2017. He received a Master of Engineering, and in 2022, he received the scientific qualification Researcher. Works as a Senior Lecturer at the Department of Computer Systems and Networks of Polotsk University. Research interests include image processing, machine learning, mathematical modeling, and information security systems.

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