

## **REVIEW**

### **BY THE FOREIGN SCIENTIFIC CONSULTANT**

on the dissertation work of Didar Muratuly titled "Development of an Information-Analytical System for Constructing and Verifying Subject Behavior Models Based on Video Material Analysis", submitted for the degree of Doctor of Philosophy (PhD) in the specialty 8D06101 "Information Systems (by Industry)".

The dissertation of Didar Muratuly addresses a highly relevant scientific and applied problem: the development of intelligent systems for analyzing subject behavior based on video processing. The work holds significant scientific and practical importance as its results are applicable in educational proctoring systems, which is particularly critical given the growing demand for remote learning and assessment methods. The author has examined a wide range of issues related to biometric authentication, behavior monitoring, as well as the detection and analysis of anomalies during remote examinations.

The objective of the dissertation research is to develop an intelligent system for constructing and verifying subject behavior models based on video analysis, capable of accounting for various external conditions, including image quality and hardware performance. The achieved results demonstrate a high level of scientific novelty, validity, and practical value.

The dissertation consists of an introduction, three main chapters, a conclusion, a bibliography, and appendices.

In the introduction, the author substantiates the relevance of the topic, formulates the research objectives and tasks, identifies its scientific novelty, theoretical and practical significance, and highlights the research methods used.

The first chapter is dedicated to analyzing modern approaches to the use of computer vision and biometric technologies in proctoring systems. The author thoroughly studied and systematized a large number of literary sources, which allowed for identifying key trends, existing limitations, and potential directions for further research. Special attention is given to methods of video analysis for constructing behavioral models and detecting anomalies, which form an important theoretical foundation for the dissertation research.

The second chapter presents the results of studies aimed at developing a methodology for timing the detection of violations during remote examinations. The author proposes approaches to optimizing the time frames for identifying violations, which is particularly important for ensuring the reliability of educational processes. Additionally, algorithms based on machine learning and data analysis methods are described for automating the monitoring of examinations.

The third chapter is experimental. It presents the development and implementation of the systems proposed by the author. The experiments conducted confirmed the effectiveness of the developed algorithms for biometric authentication and behavior analysis. The author provides a detailed description of the experimental methodology, data selection criteria, and key results, demonstrating the high reliability of the conclusions drawn.

The scientific novelty of the dissertation lies in the development of new methods and algorithms aimed at:

1. Creating a biometric authentication system based on facial recognition with high identification accuracy.
2. Optimizing the process of monitoring student behavior during online exams using a violation timing methodology.
3. Developing movement tracking methods to monitor abnormal student behavior.

These results not only improve the accuracy and speed of proctoring systems but also ensure transparency and academic integrity in the educational environment.

The practical significance of the work is confirmed by the implementation of the developed information-analytical system into the "Digital University" ecosystem at D. Serikbayev East Kazakhstan Technical University. The system has already proven its effectiveness by ensuring the quality control of remote examinations.

The dissertation by Muratuly Didar is carried out at a high scientific level. The author demonstrated independence, a creative approach, and deep knowledge in the field of computer vision and biometric technologies. Notably, the author's ability to analyze and interpret results is evident in the logical structure and coherent content of the work. The work maintains internal logical consistency. Each scientific statement is supported by experimental data and modeling results. Additionally, it is noteworthy that all stated research objectives have been accomplished, and the goals have been achieved.

The dissertation by Muratuly Didar represents a completed scientific study of high relevance, as well as theoretical and practical significance. The author has demonstrated a high level of expertise in the research area and the ability to independently address complex scientific problems.

The results of the dissertation have been published in international peer-reviewed journals, indicating the recognition of the work by the scientific community. The implementation of the proposed solutions in the educational system further confirms the practical significance of the findings.

The dissertation meets all the requirements for the award of the Doctor of Philosophy (PhD) degree, and its author fully deserves to be granted this degree.

### **Foreign Scientific Advisor:**

Corresponding Member of the National Academy of Sciences of Ukraine, Professor, Doctor of Physical and Mathematical Sciences, Head of the Department of Theoretical Cybernetics, Faculty of Computer Science and Cybernetics, Taras Shevchenko National University of Kyiv, Kyiv

