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USING ORTHOGONAL FUNCTIONS AS A DESCRIPTION TRANSFORMATION APPARATUS FOR IMAGE RECOGNITION OF VISUAL OBJECTS

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Research on the construction of modifications for the space of classification features based on the application of the transformation of the structural description through the decomposition in the orthogonal basis and the implementation of the distance matrix model between the components of the description can be used to improve computer vision methods. Using orthogonal functions as a tool for transforming the description demonstrated the potential for achieving substantial improvements in processing speed while preserving high levels of classification accuracy and resistance to interference.

Reducing the time for encoding and classifying images of visual objects is an important task for developers of modern intelligent systems. The use of orthogonal functions as a description transformation apparatus to optimize the process is potentially a possible solution to the problem of accelerating classification [1, 2].

The critical factors for optimizing the effectiveness of this representation involve selecting a metric to map the modified descriptions and determining a threshold to determine the similarity of components in the newly generated data space.

By implementing the distance matrix model, it became possible to create efficient integrated features in the form of one-dimensional data distributions and vectors representing the sum of the matrix columns. This resulted in reduced computational expenses while maintaining the classification effectiveness of the original data sample. A software simulation was conducted to experimentally evaluate the effectiveness of image classification in newly created feature spaces and the time required to calculate the relevance of descriptions.

This was compared to the traditional approach of voting and calculating metrics on a set of descriptors. The research introduces a novel approach to image classification by enhancing the structural method. This is achieved through the implementation of description transformation using orthogonal decomposition of data and the construction of feature models based on distance matrices in the descriptor space [3, 4]. Additionally, the research proposes methods to reduce descriptions in newly created spaces, resulting in reduced computational costs for classification. The practical significance of this work lies in the development of classification models in the transformed data space, verification of the effectiveness and resilience of the proposed modifications using image examples, and the creation of software applications to implement the developed classifiers in computer vision systems. Research perspectives may pertain to developing a range of proposed models for the creation and examination of changes in descriptions inside extensive databases.

The experimental calculation of the accuracy of the classification showed that for a set of descriptors of the training sample (120 vectors in the researched etalons), all the descriptors are classified correctly. Thus, the accuracy index about the set of etalon components is equal to 1 [5]. In the distance matrices, zeros are found only for the etalon itself. This can be explained by the high dimensionality of the data (488), which practically excludes random coincidences of bits in multidimensional vectors. At the same time, it is clear that for real situations under the influence of obstacles or geometric transformations of the image, the accuracy index may be somewhat lower.

The use of a system of orthogonal functions as a description transformation apparatus has shown the possibility of a significant gain in processing speed while maintaining high levels of classification accuracy and noise immunity. The effectiveness of the synthesized feature systems is confirmed by a significant increase in coding speed and a sufficient level of efficiency. An experimental example showed that the time spent calculating the relevance of descriptions from their modified representation is more than ten times shorter than for traditional metric approaches [5].

The developed classification features can be used in applied tasks where the time of identification of visual objects is critical.

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