результатов решения математических задач в различных предметных областях.

Применение смешанной модели обучения позволило осуществить инновационный и творческий подход к преподаванию дисциплины «Численные методы».

Список литературы.

1. Баркова, Е. А. Реализация модели смешанного обучения кафедрой высшей математики БГУИР / Е. А. Баркова, Т. С. Степанова // Актуальные проблемы развития системы образования в условиях информационного общества : сборник статей Международной научно-практической дистанционной конференции, Могилев, 29 декабря 2020 г. / Могилевский государственный областной институт развития образования ; редкол.: М. М. Жудро [и др.]. – Могилев, 2021. – С. 32–33.

УДК 378

TECHNOLOGY OF COMPUTER VISION: VIDEO ANALYTICS

BEKNAZAROVA SAIDA SAFIBULLAYEVNA[1], ABDULLAYEVA XURSHIDA KARIMBERDI KIZI[1], USMANOV AKBAR[1]

[1]Tashkent University of Information Technologies named by Muhammad Al-Khwarizmi, Tashkent, Republic of Uzbekistan

Abstract: The article dedicated video analytics is a technology that uses computer vision methods for automated acquisition of various data based on analysis sequence of images coming from video cameras in the mode real time or from archival records. Under the task of discovery dynamic objects is understood as the task of detection and selection changing areas of the image in a sequence of frames. Accordingly, the detection of a certain object means the choice one or more detected dynamic objects that have some similar features with a given search object. Features are selected according to the algorithm. Search process object is complicated by affine, projective distortions, overlapping object by other objects and receiver (sensor) noise. For real practical applications, the task is to process the video sequencein the real speed of receiving the data stream.

Keywords: method, algorithm, searching an object, video stream.

ТЕХНОЛОГИЯ КОМПЬЮТЕРНОГО ЗРЕНИЯ: ВИДЕОАНАЛИТИКА

БЕКНАЗАРОВА САИДА САФИБУЛЛАЕВНА[1], АБДУЛЛАЕВА ХУРШИДА КАРИМБЕРДИ КЫЗЫ[1], УСМАНОВ АКБАР[1]

[1]Ташкентский университет информационных технологий имени Мухаммеда аль-Хорезми, Ташкент, Республика Узбекистан

Аннотация: Методы компьютерного зрения для автоматизированного сбора различных данных, основанные на анализе последовательности изображений, поступающих с видеокамер в режиме реального времени или из архивных записей. под задачей обнаружения динамических объектов понимается задача обнаружения и выделения изменяющихся областей изображения в последовательности кадров. соответственно, обнаружение определенного объекта означает выбор одного или более обнаруженных динамических объектов, которые имеют некоторые сходные признаки с данным объектом поиска. функции выбираются в соответствии с алгоритмом. процесс поиска объекта осложняется аффинными, проективными искажениями, перекрытием объекта другими объектами и шумами приемника (датчика). для реальных практических приложений задача состоит в том, чтобы обработать видеопоследовательность с реальной скоростью приема потока данных.

Ключевые слова: способ, алгоритм, поиск объекта, видеопоток.

According to the system requirement, the algorithm should be based on the search for the key points of the object. The conducted studies have shown that the ASIFT method is the most resistant to the criteria considered. ASIFT is based on the SIFT method, which has a fast–acting analogue - the SURF method.

The SIFT method is the most resistant to the criteria considered, but has a high computational complexity. The SIFT algorithm is a complication of the SIFT method, which makes it possible to achieve stability to all affine transformations by modeling changes in camera tilt. According to the constructed functional model, the camera tilt changes are generated by the A12 function, thereby the ASIFT method becomes redundant in finding singular points.

In SIFT, the key point is considered to be the local extremum in the scalable space of the Gaussian difference. In the fast–acting analog, the SURF method [1], the key point is the local extremum of the determinant of the Hesse matrix. In practice, the SURF algorithm allocates fewer key points on the object image, but has a high frame processing speed compared to the SIFT method [2]. To quickly find key points and calculate descriptors, it is proposed to use the SURF method as a basis.

Considering the constructed functional model, the stability to scaling in the system is achieved by performing the A13 function on the image of the desired object, therefore, the SURF method has been upgraded: the search for key points is performed only on one octave. In this regard, the computational complexity of the upgraded method is reduced by s times, where s is the number of octaves.

Algorithms and methods for finding the intersection of descriptors

To find the intersection of two descriptor sets , the following approaches are actively used today:

- the RANSAC method;
- the Kuhn – Mankres algorithm.

RANSAC – This is a general method that is used to estimate model parameters based on random samples. When compared, the model is a transformation matrix (homography). There are two sets of descriptors at the input of the algorithm. The scheme of work of RANSAC consists of repeated repetition of three stages:

1. Selection of points and construction of model parameters. From the input sets of descriptors, sets of fixed size are randomly selected without repetition. Based on the obtained sets, a transformation matrix is constructed.

2. Checking the constructed model. For each descriptor of the object image, a projection is located on the current frame and a search is performed for the closest descriptor from the set of descriptors of the current frame. The descriptor is marked as an outlier if the distance between the projection and the corresponding descriptor of the current image is greater than a certain threshold.

3. Replacement of the model. After checking all the points, it is checked whether the constructed model is the best among the set of previous models. As a result of using RANSAC, the best homography matrix is constructed. Having calculated the perspective projection of a set of object image descriptors, it is enough to pass through all the correspondences obtained during the iteration and check whether the corresponding descriptor of the current frame is close enough to the projection of the object image descriptor. If it is not, then the pair is discarded [4].

According to [5] for one model, the computational complexity will be $O(n)$, however, in practice, the results are unacceptable for use due to the large number of possible errors [11]. There are modifications of the RANSAC method. For example, the G-Linkage algorithm and the kernel adaptation algorithm, which allow finding pairs with fewer errors, but with computational complexity $O(n^2)$ [6]. The Fischer scaled Compressed Vector algorithm with RANSAC (SCFV-RANSAC) [7] similarly has fewer errors due to additional processing of the set of descriptors for matching.

The Kuhn-Mankres algorithm

The task of matching descriptors can be represented as an assignment task. We interpret it into a graph form. Let the mask parameters (descriptors) be the vertices of the graph, and the values of the vertex similarity measure are the edges of this graph. The complexity of the original algorithm is $O(n^4)$. To solve the problem by the Kuhn-Mankres method, it is necessary to add new virtual vertices of the graph, which will be infinitely removed from other vertices. Then $K_{n,n}[W]$ – weighted graph with fractions X and Y. The output of the method is the set of edges of the optimal match P in this column.

The Kuhn – Mankres method can be represented as the following sequential operations:

1. Set to $K_{n,n}[W]$ arbitrary acceptable markup f and find a subgraph of equalities $G_{W,f}$.

2. Using the Hungarian algorithm to find the maximum match P in the graph $G_{W,f}$ and a lot of F free relatively P share vertices X.

3. If $F = 0$, finish the job.

4. Find all alternating chains in the graph $G_{W,f}$, starting in F, put S and T equal to the set of all vertices of the fraction X (accordingly, the shares Y), met in these chains.

5. If in T there are no free vertices, put

$$\Delta = \min_{x_i \in S, y_j \in Y/T} \{f(x_i) + f(y_j) - w_{ij}\},$$

Where $f(x) = f(x) - \Delta$ for everyone $x \in S, f(y) = f(y) + \Delta$ for everyone $y \in T$, find a new graph $G_{W,f}$ and go back a step 4.

6. Increase P, by repainting the magnifying chain found, and go back a step 3 [8].

Algorithm for limiting the search area of an object in the frame

The algorithm for limiting the object search area evaluates the scale of the object image by the descriptors of key points according to the following scheme:

1. Find for each key point of the frame the closest match from the set of projectively distorted images of the sample.

2. Remove from further consideration the key points of the frame that have the value of the proximity measure below the threshold Thr.

3. For each remaining key point of the frame, build a rectangular area. The coordinates of the selected area in the image are determined by the coordinates of the corresponding key point in the distorted image of the sample.

4. From the set of key points for further analysis, leave only those whose rectangular areas have intersection areas with other rectangular areas less than half the area of the rectangular area of the considered key point.

The algorithm is presented in more detail in the form of a flowchart in Figures 1 and 2, constructed on the threshold of the proximity measure of descriptors.

The measure of proximity between the frame descriptors and the sample image is calculated by the Bhattacharya coefficient [9]:

$$p = \sum_{i=0}^{n-1} \sqrt{a_i \cdot b_i},$$

where a, b – dimension vectors n, p – measure of proximity, $p \in [0,1]$.

The proposed algorithm has less computational complexity than the algorithms of RANSAC and Kuhn-Mankres. However, the disadvantage of this approach is to determine the Threshold value.

The identification algorithm should determine whether the area on the frame is an image or part of the image of the object. To do this, the algorithm must find the parameters of the window on the frame by the found areas obtained based on the comparison of local image features – key points. Let the identification algorithm find the object by an elliptical window. The algorithm suggests using a method based on the global property of the image. One of the most common global characteristics is the color histogram [10]. The color histogram is calculated quickly, however, the spatial arrangement of pixels is not taken into account when calculating. It is proposed to enter the point color values with a certain weight: the closer the point is to the center of the window, the greater its weight. This is also necessary so that small window offsets lead to small changes in the mapping error.

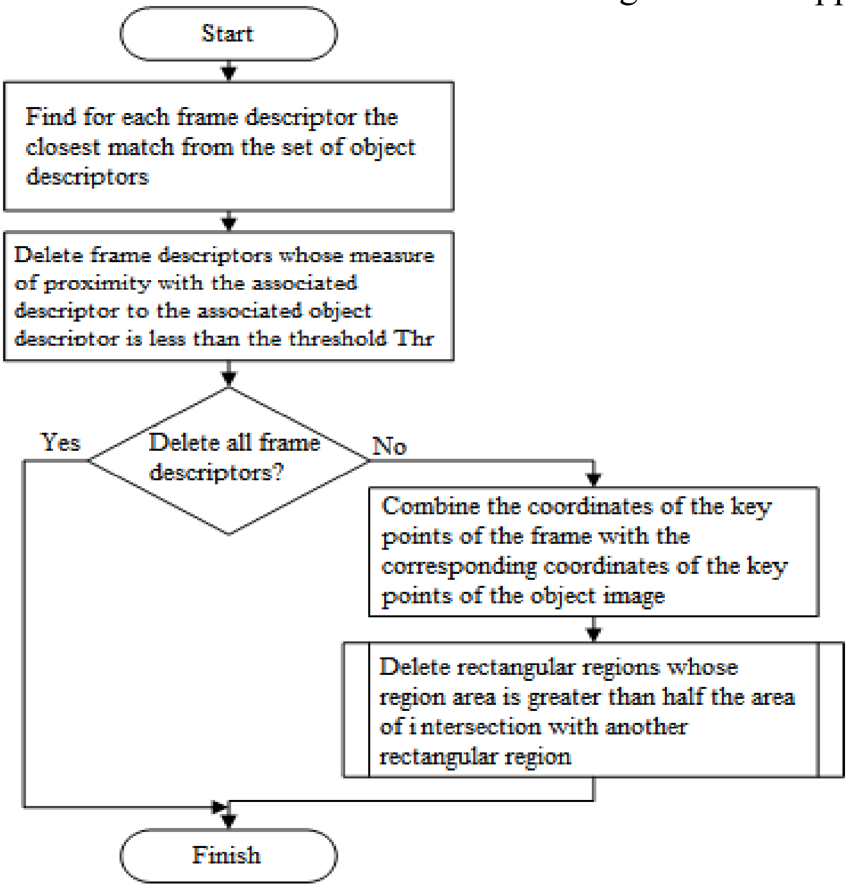

Figure 1-block-circuit algorithm limited areas requested in Cadre

This condition corresponds to the core of Epanechnikov [10]:

$$K(x) = \begin{cases} 1 - x^2, |x| \leq 1 \\ 0, \ |x| > 1 \end{cases}.$$

Thus, the color of the pixel x will be entered into the color histogram with a certain weight *K(x)*.

Reference:

1. Guoshen, Yu. ASIFT: An Algorithm for Fully Affine Invariant Comparison, Image Processing On Line / Yu. Guoshen, M. Jean-Michel//Image Processing On Line. – 2011 – №1. http://www.ipol.im/pub/art/2011/my-asift/article.pdf.
2. Viola, P. Rapid Object Detection using a Boosted Cascade of Simple Features / P. Viola // Accepted Conference on Computer Vision and Pattern Recognition (CVPR 2021). – 2021. – p. 511–518..
3. Lowe, D. G. Distinctive Image Features from Scale-Invariant Keypoints/ D. G. Lowe // International of computer vision. – 2014. – p. 28–29.
4. Mann, S. «GlassEyes»: The Theory of EyeTap Digital Eye Glass, / S. Mann // IEEE Technology and Society. – 2012. http://wearcam.org/glass.pdf.

5. Kenneth, D.-H. A Practical Introduction to Computer Vision with OpenCV / D.-H. Kenneth. – Ireland: Trinity College Dublin, Ireland, 2014, – 234 p. – ISBN 978-1-118-84845-6.

6. Bernatovich A. S. An active experiment in the identification of functional systems for the operational implementation of simulation-type models / / Cybernetics.- 1983. - No. 1. - pp. 99-104.

7. Ayvazyan S. A., Bukhstaber V. M., Enyukov I. S., Meshalkin L. D. Applied statistics. Classification and dimension reduction. Moscow: Finance and Statistics, 1989. 608 p.

8. Anderson D. Tannehill G. Pletcher R. 1990 Vychislitelnya gidromehanika i petloobmen (Moscow: Mir) Moscow: Nauka)

9. N. Sedova, V. Sedov, R. Bazhenov, A. Karavka, S.Beknazarova. Automated Stationary Obstacle Avoidance When Navigating a Marine Craft //2019 International Multi-Conference on Engineering, Computer and Information Sciences, SIBIRCON 2019; Novosibirsk; Russian Federation; 21 October 2019

10. Beknazarova S., Mukhamadiyev A.Sh. Jaumitbayeva M.K.Processing color images, brightness and color conversion//International Conference on Information Science and Communications Technologies ICISCT 2019 Applications, Trends and Opportunities. Tashkent 2019

УДК 53:378.147

ОСОБЕННОСТИ АДАПТАЦИИ ИНОСТРАННЫХ СЛУШАТЕЛЕЙ К ДЕЙСТВУЮЩЕЙ ТЕРМИНОЛОГИИ ПРИ ОБУЧЕНИИ ФИЗИКЕ НА ПОДГОТОВИТЕЛЬНОМ ОТДЕЛЕНИИ

БЕЛЫЙ В.В., БУДЬКО И.В., ГОРБАЧЕВСКИЙ Д.А.
Белорусский национальный технический университет, Республика Беларусь

FEATURES OF ADAPTATION OF FOREIGN STUDENTS TO THE CURRENT TERMINOLOGY WHEN TEACHING PHYSICS AT THE PREPARATION DEPARTMENT

BELY V.V., BUDZKO I.V., GORBACHEVSKY D.A.
Belarusian National Technical University, Republic of Belarus

Abstract: The material describes the features of the adaptation of foreign students to Russian terms during their training at the preparatory department of a technical university. Methodical approaches for teaching physics to this contingent of students are proposed: – studying a multilingual dictionary of special terms at the beginning of each lesson and recording this dictionary on the mobile phone of each student; – a combination of a simple adapted text with the solution of problems and tests, where the studied terms appear in the form of formulas.

Keywords: special terms, physics, teaching foreign students

Традиционный контингент подготовительного отделения для иностранных слушателей состоит из представителей многих национальностей: китайцы, узбеки, латиноамериканцы, граждане