могут быть либо примерами из обучающего набора, либо синтетическими изображениями, созданные с помощью самой модели внешнего вида. Там, где используются синтетические изображения, можно либо использовать подходящий (например, случайный) фон, либо можно обнаружить области модели, которые перекрывают фон и удалить эти образцы из процесса построения модели. Где фон предсказуем (например, медицинские изображения), в этом нет необходимости.

Заключение. Описан метод активной модели внешнего вида. Был применен приведенный выше метод к модели лица. Можно визуализировать эффекты возмущения следующим образом. Если $\vec{a}_i$ I-я строка матрицы $\vec{R}$, прогнозируемое изменение I-го параметра $\delta\vec{c}_i$ задается формулой $\delta\vec{c}_i = \vec{a}_i \delta g$, и $\vec{a}_i$ - вес прикрепленный к различным областям объекта, когда оценивается перемещение.

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METHOD FOR CALCULATING THE DEPTH MAP FROM A STEREO PAIR

Introduction. Active and passive methods of restoring information about the depth of a real scene are known. Active methods use laser illumination of the working space, giving the output fast and accurate information about the depth [1]. However, these methods have limitations with respect to the measurement range and cost of hardware components.

Passive methods based on computer vision are usually implemented with simpler and less expensive distance sensors. Such methods are able to generate depth information from the obtained pair of images and parameters of two cameras [2, 3]. One of the fundamental problems of stereo vision is to establish an exact match between the left and right image of the stereo pair. Correspondence refers to the distance (disparity) between pixels of the same object on the left and right image. This paper describes a passive method for calculating the depth map in real time on a GPU.

Method description. The left and right channels are treated identically. Gradient images of the stereo pair are calculated using the convolution method

$$I_{out}(x,y) = \sum_{k,l \in A(x,y)} I_{in}(k,l) \cdot M(k,l) \qquad (1)$$

where I_{out} is the processed pixel; I_{in} is the original pixel in the image; *A (x, y)* is the neighborhood of 3×3 pixels; *M (k,l)* is the element of the convolution matrix.

The use of such preprocessing significantly reduces the probability of error in calculating the pixel depth, especially in the presence of homogeneous, low-contrast areas on the stereo pair.

Next, a linear combination of the gradient and source images with a variable parameter p is calculated. The disparity of pixel d is by definition equal to the distance between the corresponding pixels of the left and right images. Matching is performed line by line by iterating over the pixels on the selected row of images y

$$d = |x_r - x_l| \qquad (2)$$

Here *xl* is the position of the selected pixel of the fixed line y on the left image; *xr* is the position of the corresponding pixel of this line on the right image. To find *xr*, for each element (x, y) of the row y of the right image, the sum of the values of pixels *I* with neighborhoods is calculated

$$I(x,y,d) = \sum_{k,l \in B(x,y)} C(k,d,l) \qquad (3)$$

where *B(x, y)* is a two - dimensional neighborhood (window) of pixels centered at a point (x, y). The cost is understood as the difference module of the left (selected) and right (selected) pixels:

$$C(x,d,y) = |p_l(x,y) - p_r(x-d,y)| \qquad (4)$$

where *pl* is the pixel on the left image; *pr* is the pixel on the right image; *d* is the disparity.

Next, the minimum value corresponding to the position of the pixel with coordinates (xl-d, y) on the right image is selected from all the values obtained by brute force. Therefore, the most similar pixels and their surroundings on the left and right image along the horizontal line will form the minimum cost. The method is implemented using CUDA technology, which provides high flexibility and convenience in the interaction between the CPU and GPU. SIMT architecture is very similar to SIMD (single instruction, multiple data). In the case of SIMD, the developer and compiler need to spend a lot of effort to fill in the vectors. Moreover, in SIMT, instructions define the behavior of a single thread. The advantage of CUDA is that the compiled program will run on various graphics accelerators. In addition, the execution result will be the same, even though they may have different numbers of stream multiprocessors. For tests, a solution with a graphics accelerator is ten times faster than a CPU-based version.

Conclusion. A method for calculating the depth map in real time on a graphics processor is proposed. The proposed method uses two one - dimensional sparse Windows-vertical and horizontal-to achieve an optimal balance between speed and quality. Each window is built from the center of the pixel in question. Under the discharge is understood that the window does not consist of the nearest pixels to each other, but of pixels located at a certain specified distance from each other, for example, two, four, six pixels. This allows you to significantly increase the speed of calculations with a slight increase in error. In the process of developing this method, the ways of possible improvement of the quality and optimization of the speed of calculations were identified. For example [4], you can use segmentation of the input image to almost completely remove noise and increase the clarity of the object boundaries on the depth map. This will allow you to find the depth map not for each specific pixel of the image, but for a set of segments-image planes.

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