**Využitie počítačového videnia v sledovaní dráhy laboratórnych zvierat** – dočasný pracovný názov

**Introduction**

Definovanie problému z medicínskeho hľadiska, význam riešenia uvedenej problematiky, prehľad súčasného stavu riešení a algoritmov

* Koniar, Hargaš, Simonová + Martinčania

**Methods**

Použitý kamerový systém, snímaná scéna, formáty záznamov

* Koniar, Hargaš, Simonová + Martinčania

Metódy použité na segmentáciu videosúborov:

Globálne, lokálne, farebné prahovanie (RGB vs. HSV)

Color Matching / Color Location / Matching-y

Rozdielové metódy detekcie pohybu

Algoritmy robotikov – Fero et. Al

Detection of laboratory animals’ motion can be defined as a change in position of the animal relative to its surroundings. There are several ways how to separate the motion of the moving object from the surroundings. One of the best known is to use **Differential Images method**. This method considers the video sequence as the linear subsequence of images with some delay between them. If all the pixels from two images are compared and they are the same, conclusion that these two images are identical can be made. But if they are not the same, something happened during the delay time. Differential Images method substracts two images. However, there are several different combinations of substracting two images. **Method of Collins et al.** was used, because this method erases the ghosting effect. Ghosting effect appears when receiving a distorted or multipath input signal and this happens when substracting two images. Collins et al. uses three images, which are called previous, current and next. Collins method substracts the images previous and next and then it substracts the images current and next. After this a logical operation AND between the both results is performed and threshold to the final results is applied. This will lead only to large changes in sequence of images. These changes in the image will be indicated by white dots in the image. When motion is detected (white dots appeared), minimal and maximal positions of the dots are evaluated. These minimal and maximal positions are used to compute the bounding rectangle. Centroid of this rectangle is then computed. By the comparison of two consequent centroids, the motion of animal can be expressed by the amount of pixels. It is clear that this can works if only one moving object is detected in image. If the scene consists of only single animal, this method has a high performance and effectivity. However, it can generate lots of false positive, especially if the wrong threshold has been chosen. Picking the right threshold is crucial, and some motion detection algorithms pick a dynamic or adaptive threshold. However, a dynamic threshold can still fail and give false positives either. Robust motion detection algorithms tackle these problems with ease, but they need a lot of extra CPU power to succeed. Sometimes it is not available. This is another advantage of Differential Images method. Moreover, there is a simple trick to erase the false positives. This trick assumes that the motion only occur in a sequence of images larger than one. Another parameter, which can be used to neglect false positives, is the standard deviation. The standard deviation tells about the distribution of motion. When motion is specific at a single pixel, the standard deviation will be near to zero. When a lot of motion is detected and it is distributed over the entire image, then the standard deviation will be very high. However, huge distribution mostly indicates no real motion. So the used algorithm consists of followed steps:

1. Create the sequence of images: previous, current and next frame. Actually, the next frame is currently captured frame from the video sequence. Current frame is the last frame from the previous sequence, etc.
2. Apply method of Collins et al. with the application of Differential Images method.
3. Choose appropriate threshold and operations of mathematical morphology (neglect the false positives).
4. Evaluate the number of changes.
5. Neglect the huge motion on the basis of standard deviation.
6. Determine the bounding rectangle of the motion and the position of rectangle’s centroid.
7. Compare the position of rectangle’s centroid with the position of previous one and determine the difference in pixels.
8. Add the result to the total amount of motion.
9. Go to the point 1, until all the sequence is analyzed.

Peto: Approach with motion detection

**Motion detection**

Real-time segmentation of moving regions in image sequences is a essential step in many vision systems. A typical method is background subtraction. Many background models have been introduced to deal with different problems. Background subtraction involves calculating a reference image, subtracting each new frame from this image and thresholding the result. What results is a binary segmentation of the image which highlights regions of non-stationary objects. One of the successful solutions to these problems is to use a multi-colour background model per pixel proposed by Grimson et al. [1,2,3]. These methods suffers from slow learning at the beginning, especially in busy environments, and it is not able to distinguish between moving shadows and moving objects. Method was later improved by P. KaewTraKulPong and R. Bowden [4]. They utilized different update equations at different phases of algorithm. That allowed system to learn faster and adapt effectively to changing environments. They also improved algorithm by introducing shadow detection scheme, which is based on computational color space that makeds use of background model. This method is implemented in OpenCV (Open Source Computer Vision) library in MOG background substractor class, and we used it.

**The algorithm**

Firstly, we use median filter to remove background reflections from the processed frame. Then our algorithm uses MOG background subtractor to detect moving object and create binary image for each frame processed. We reduce noisy pixels in binary image with erosion, then we restore image with dilation. At last, we calculate center of mass of moving pixels in current frame and add coordinates of this point into pose graph as new node. We drop false detections - poses either when detected pose is too close to last detected pose, or when there are not enough moving pixels in the frame. Therefore, number of nodes in the pose graph is not equal to number of frames in the video. To get total length of trajectory which object travelled in pixels, we calculate length of all line segments connecting graph nodes. Conversion of pixel length to metric length is trivial, if we know dimensions of the cage.

Popis a rozdelenie snímanej scény na oblasti: zviera, kŕmidlo, podstielka, mreža – ak je to relevantné pre niektorú z metód

Morfológia po segmentácii

Vyhľadanie ťažiska objektu – zápis súradníc pohybu – vytvorenie trajektórie – filtrovanie trajektórie

**Experiment a diskusia**

Náš návrh:

Vyberieme niekoľko reprezentačných úsekov denné aj nočné, aplikujeme algoritmy a vyhodnotíme úspešnosť, náročnosť a podobné kydy

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Alebo ak máte návrh vy

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