A computer vision-based system towards safety for nuclear plants personnel

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Video surveillance has been a very active R&D field which spans through many different applications, such as monitoring people activities in public or controlled places, in general for safety or security purposes. Just to cite some application examples, tracking people in video may help to detect suspect behavior, such as certain movements and interactions, or the carrying of certain objects. A good overview of surveillance approaches and applications may be found in [1]. This work focuses on a specific problem related to safety for nuclear plants' personnel. The surveillance system aims at detecting and tracking people in movement in a nuclear plant, in order to estimate the radiation dose they may be receiving, based on their tracked positions and on the available radiation dose rate mapping within the environment. The experimental part of this research was carried out at the Argouauta nuclear research reactor (Argonauta, for short), a nuclear plant at the *Instituto de Engenharia Nuclear* (Nuclear Engineering Institute - IEN), *Comissão Nacional de Energia Nuclear* (Brazilian Nuclear Energy Commission - CNEN). This work focuses on a monitoring system which aims at improving safety for personnel and at providing a decision support system for managers. The objective is to assist these managers in both monitoring personnel activities within the nuclear plant and deciding if a worker should be substituted, depending on the radiation dose he/ she receives (in fulfillment of the ALARA's requisite [2]). A previous work introduced this research project [3], in which some results were presented for background subtraction – a stage that is commonly applied for detecting and tracking people in video – by using different approaches. Currently, this R&D has moved some steps further, by combining background subtraction with a well-known tracking method based on color distribution. An alternative approach using a blind source signal separation (BSS) method has also been evaluated. Results have been shown and discussed, along with possible future advances and some methods have been implemented, namely, [3]: (i) Gaussian mixture modeling (GMM); (ii) Camshift; a combination between both GMM and Camshift; and (iv) the BSS method named Independent Component Analysis (ICA).

New databases were obtained: (i) dose rate distribution; and (ii) an extensive video database. The latter is specific to the problem and is quite different from existing ones. Data was processed for camera calibration and projective matrices estimation, to predict people's coordinates in the plant. Persons were manually marked (ground truth) for comparative analysis. Figure 1 shows some of the results obtained by different tracking methods. As none of them gave appropriate results, a new system had to be proposed. Ground truth is shown in red, while other colors denote the evaluated methods.

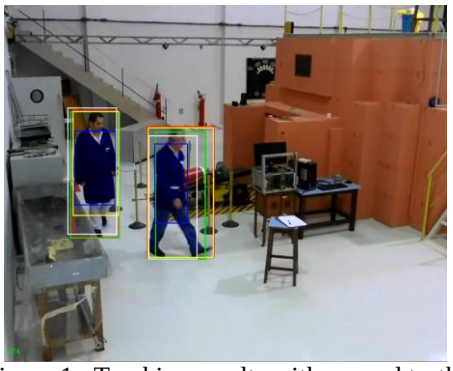

Figure 1. Tracking results with ground truth.

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