講演番号	087

文献番号	20226087

Study on Improving Semi-Automated Active Learning Through Conventional Feature Extraction Methods

Ang Li [1)] **Toshio Ito** [2)3)]

1) Shibaura Institute of Technology, Graduate School of System and Engineering
307 Fukasaku, Minuma-ku, Saitama-City, Saitama, 337-8570, Japan
2) Shibaura Institute of Technology, Department of Machinery and Control Systems
307 Fukasaku, Minuma-ku, Saitama-City, Saitama, 337-8570, Japan
3) Hyper Digital Twins Co., Ltd. (HDT), Niu Building 2F, 2-1-17, Nihonbashi, Chuo-ku, 103-0027, Japan

KEY WORDS: **electronic and control, image recognition system, image processing**, active learning, AKAZE algorithm (E1)

While most deep learning neural network models are already widely used today in computer vision processing systems for autonomous driving, a large number of detection samples and training time is still required to achieve the desired detection performance, which also entails significant human work for annotations and very advanced hardware for model training. For improving the performance of active learning, the method of combining image feature extraction methods and artificial neural networks in active learning to assist people to annotate and locate objects in images was proposed by Dr. Hafiz Hilma. In his paper, he named the method that consists of a pre-trained neural network You Only Look Once version3 model and Lucas Kanade Optical Flow algorithm to compose an automatic identifier for assisting manual processing of query samples named Machine Teachers (Mts). Using MTs to assist manual oracle could construct a semi-automated active learning system (SAAL). This method reduced the labor costs and model training time, the processing flows are shown in Fig. 1, when active learning classifies some unidentifiable samples, it will send those query requests to an annotation oracle composed of humans and MTs. Although this method can largely reduce the workload of manual labeling, however, it does not cope well with real, complex road traffic situations and the calculation speed is also not satisfactory when processing multiple target samples at the same time.

To improve the performance of this method, in this paper, we propose the use of the ORB feature extraction algorithm instead of the LK-optical flow to implement a new SAAL system. Because compared with Optical Flow, the ORB algorithm has extraordinary performance in scale invariance, direction invariance, and the ability to perform fast calculations.

However, the ORB algorithm was proposed for keypoint extraction, it is different from optical Flow which was usually used for object tracking, so in our paper, we propose a method that uses keypoint matching to track objects between frames. The detailed procedure is shown in Fig.2.

According to our experiments' results, our proposed SAAL system could improve the annotation effectiveness for queried samples, and the computing speed was also enhanced considerably. Our MTs could process 17.8% of queried samples for human oracles which can further reduce the human cost of training models. On the contrary, our proposed MTs also has many problems and needs improvement. Firstly, the mAP and recall of our MTs are not ideal in identifying and processing samples, and secondly, it does not have good results in processing some challenging samples and relies excessively on the pre-trained neural network model. Next,we will continue to work on improving the detection of MTs and allowing MTs to take on more workload for human oracle.

Although our proposed MTs have much potential for improvement, they are helpful in reducing the manual effort and increasing the sample processing speed for training some scenario-specific models, especially for small embedded neural network models that can be mounted on vehicles such as MobileNet-V2 or other small-sized models that can be mounted on OpenMV or Raspberry Pi.

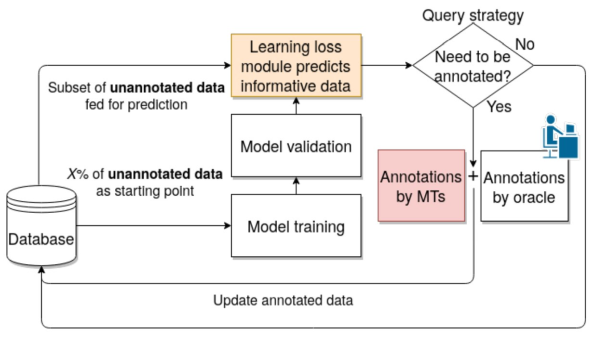

Fig.1 Proposed Semi-Automated Active Learning

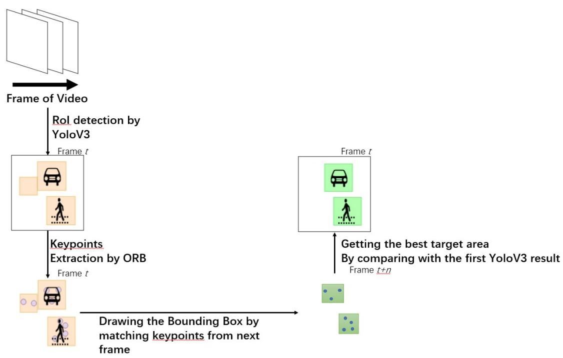

Fig.2 ORB target tracking procedure in MTs