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(57) Abstract :
Technology of microfluidics in single-cell monitoring and imaging is rapidly growing. A deep learning algorithm based on Contrastive Language-Image Pre-training (CLIP) models and feature interleaving is proposed to classify the microfluidic time-lapse images of dividing yeast cells into various categories. Processing and analyzing microfluidics images is challenging because of their low resolution. Monitoring of cell development and classification of cells in microfluidic devices is not fully automatic and demands human intervention and is time-consuming. The dataset consists of time-lapse images having a resolution of 1280 x 960. The time-lapse images are subdivided into images of 60x60 resolution. There are five classes i.e., a trap with no cell (nC), trap with a single mother cell (mC), a trap with one mother and one upward-oriented daughter cells (mduC), a trap with one mother and one downward-oriented daughter cells (mddC), and a trap with more than two cells (exC). Biologically there are four classes as mduC and mddC belong to same category but with different shape patterns. There are 5900 images in total and 1180 images in each category. It is a perfectly balanced dataset. If an image does not belong to nC, mC, mddC, or mduC it is kept in exC.. Here we propose an improved deep learning algorithm for accurately classifying the microfluidic images of dividing yeast cells. Features are extracted from the pre-trained CLIP models. CLIP models are trained on large image text pairs. An unsupervised training is used in zero shot image classification. Large-scale datasets comprising image-text pairs are provided by the Large-scale Artificial Intelligence Open Network (LAION) organization. LAION-5B comprises 5.85 billion multilingual image-text pairs filtered by CLIP, LAION-2B consists of 2.32 billion English image-text pairs, LAION-400M has 400 million English image-text pairs. Yahoo-Flickr Creative Commons (YFCC-15M) contains 15 million image-text pairs and Conceptual Captions (CC-12M) contains 12 million image-text pairs. CoatNet, ResNet50, ResNet101, ResNet50x4, ResNet50x16, ResNet50x64, ViT-B-32, ViT-B-16, ViT-L-14, ViT-H-14, ViT-g-14, Vit-bigG-14, roberta-ViT-B-32, xlm-roberta-base-ViT-B-32, xlm-roberta-large-ViT-H-14frozen, and ConvNext_base_w are the models used.

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