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615-1 PETRI DISH IMAGE-CAPTURING GUIDELINES FOR ARTIFICIAL INTELLIGENCE-BASED MICROORGANISM RECOGNITION.

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Resumo:

Microorganisms are well-known producers of chemical substances potentially useful in biotechnology and pharmacological applications, and microbe species recognition is essential. Identifying microorganisms in clinical and microbiology laboratories takes a long time, with a high operational cost, and requires skilled labor. Our research group envisaged a strategy to automate this task using artificial intelligence, especially machine learning in the deep learning modality, based on images of cultures in Petri dishes. As such, we are developing the first image database of known and taxonomically labeled microorganisms. This database is connected to a prototype computational system, which allows the capture, annotation, storage, recovery, and recognition of images of microbes grown on solid media. We herein propose the necessary guidelines to acquire images of microorganisms cultivated in Petri dishes. To properly collect the images and build a high-quality database, we designed a height-adjustable stand equipment incorporating a Nikon Coolpix S8200 16.1MP digital camera and a set of LED lights (Figure 1). For evaluating the image capture method supported by this equipment, we outlined a protocol that entailed the triplicate inoculation of 24 actinobacterial strains taxonomically identified. The RGB images of bacteria were taken from both Petri dishes' front and back sides at 24 h intervals over time. We tested the following experimental parameters: (i) ambient lighting, (ii) equipment background color, (iii) LED lights positioning, (iv) dish material (plastic and glass), (v) culture medium (ISP1 and ISP2), and (vi) inoculation technique (agar-plug and continuous streak). Higher lighting intensity in the collection room, a white background, the attachment of lights to the sides and top of the equipment, the adoption of 100 × 20 mm glass dishes, and the camera-to-dish distance of 13 cm resulted in the best setup for capturing images. Actinobacteria growth took ten days. The most significant macroscopic differences were observed on the seventh day for the agar-plug actinobacterial growth and on the fifth day for a continuous streak inoculation. Different solid media changed the appearance of some colonies; photographing the back side of Petri dishes proved relevant in discriminating between species. Even among visually similar microbes on the front side, distinct color variations or pigment release in the medium could be observed on the Petri dishes' back side (Figure 2). Oscillations in the incubation temperature also interfered with the appearance of the colonies. The obtained results provided valid parameters and procedures to gather images of microorganisms cultivated in Petri dishes with low cost and high quality. The method can also be applied to other species, including mixed cultures. Short-term future work includes capturing, annotating, and storing images of other microbial strains. **Keywords**: Microbes, image database, automatic identification, machine learning. **Development Agency**: This study was financed in part by the Sao Paulo Research Foundation (FAPESP) [grant numbers 19/17721-9, 22/02176-8, and 22/10471-0].

Palavras-chave:

Microbes, Image database, Automatic identification, Machine learning

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