A MACHINE LEARNING COMPUTER VISION TOOL FOR PHENOTYPING TRAINING

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KEYWORDS: Genetics, AI, Machine Learning, Software, Phenotyping

BACKGROUND

An important skill in genetics and biology more broadly is the ability to distinguish between subtly different appearances (phenotypes) in individual organisms of the same or closely-related species. In large classes of naïve genetics students, we find that their skills in classifying *Drosophila* (aka fruit/vinegar flies) phenotypes are often quite poor, resulting in low quality quantitative data. Furthermore, student confidence in their classifications and phenotyping ability may be lacking in the absence of regular interactions with teaching staff. This level of interaction can be a challenge to maintain in large tertiary classroom settings. Software trained by machine learning is increasingly being used in biological applications of image recognition, especially insects (Amarathunga et al, 2021). We hypothesised such software may serve as a useful training and confidence-building assistant for phenotype classification in the classroom.

AIMS

1. Develop a training tool allowing students to compare their phenotypic predictions to those made by computer vision and AI within the classroom.
2. Assess the impact of the AI tool on students' actual ability and self-assessed confidence in phenotyping.

DESIGN AND METHODS

Our phenotyping tool was developed through training machine learning models on images of pre-classified flies, which students used via a cloud based user interface. A cohort of ~600 students in a single 2nd year genetics class were split into two. Half used our AI-informed phenotyping tool as the primary method to classify fly phenotypes by uploading microscope photographs to the system. The other half carried out phenotyping under the microscope manually. Students then participated in an anonymous survey with Likert and open-ended questions. Participants included 69 students that used our tool and 50 that did not. Inductive thematic analysis (Braun and Clarke, 2006) was performed on open-ended questions blind by two individuals independently to identify core themes.

RESULTS AND CONCLUSIONS

Interestingly, phenotyping ability, measured through making classifications on 10 novel flies within the survey, was not significantly different between those that used and those that did not use the AI tool. However, students that used our tool were significantly more likely to agree to trusting their own classification of fly phenotypes, than those that did not. This finding matches a key theme from qualitative responses: students found the comparison to the model's classification improved their confidence in, or clarity around, their own data. Both groups generally agreed the tool should be integrated into their future classes, and that using such tools can improve understanding of the applications of AI. Students that used the tool were significantly more likely to report being comfortable using AI-analysis tools in the future, suggesting a single intervention in one class may encourage students to explore or implement AI-analysis technologies going forward.

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Proceedings of the Australian Conference on Science and Mathematics Education, The University of Melbourne, 30 September - 2 October 2025, page 74, ISSN Number 2653-0481.