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| 学位記番号 | 第46号 |
| 学位授与年月日 | 令和2年3月23日 |
| 学位論文題目 | Affective Modelling and Feedback in Programming Practice Systems |
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論文要旨

Affective modelling and feedback have been shown to be potentially useful in intelligent tutoring systems. This is based on several studies showing that emotions experienced by students are correlated with various aspects of learning. The computer science community have explored ways to model and respond to student emotions in several learning domains. In my dissertation work, I focus on modelling and responding to the emotional states of university students while doing coding exercises. In this type of activity, the student acts as an individual programmer writing code alone, a setup like when a student is doing practice at home without teacher supervision. In this kind of setup, the display of emotions is more challenging to detect than that of more traditional tutoring interactions because they are more subtle and naturalistic. To address this, I use a combination of face features and system log features to train models to estimate emotion while coding. I then use these models to investigate simple affective feedback in systems for programming practice, such as generating problems and offering guides based on confusion, as well as providing emotional responses based on the affective state of the student. We found that some log features and some face features are associated with certain emotional states in programming and can be combined to train models with a slight improvement over previous approaches. We also developed two systems with simple affective feedback, EmoTutor1 and EmoTutor2, and found that these systems can help students solve more problems and have a more positive impression in terms of learning experience and engagement, when compared to

traditional methods that do not provide feedback. However, the timely presentation of such simple interventions was not found to be a significant factor in those positive effects.

審査結果の要旨

プログラミング学習時に学習者の感情をリアルタイムで認識し感情フィードバックする学習支援システムを構築して評価した。表情とシステムログの組み合わせにより感情モデリングを行い、コーディング中の感情を予測した。実験の結果、システムログと表情の両方がプログラミング中の特定の感情状態に関連付けられており、これらを組み合わせることで、従来研究よりも改善されたモデルをトレーニングできることを示した。単純な感情のフィードバックを備えたプログラミング学習システムにおいて、フィードバックを提供しない方法と比較して、学生がより多くの問題を解決し肯定的な印象を与えるのに役立つことを示した。また、このような単純な介入において提示のタイミングによる効果には大きな違いがないことを示した。博士論文として相応しい研究成果があると判断し合格とした。