Return of the Student: Predicting Re-Engagement in Mobile Learning

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Introduction

- Large scale evidence indicates that there are high levels of disengagement in mobile learning [1]
- However, what happens once a student disengages? Do students ever return?
- We find that over a third of students who disengage for a week or more eventually re-engage
- We train Random Forest models on a set of interaction-based features to create a foundation for automated interventions and to derive insight into the differences between disengagement and re-engagement prediction

Background

- Mobile learning platforms may be more suitable microlearning sessions, playing to the strengths of their form-factor [2]
- Traditional definitions of engagement need to be reconceptualized for this new context

Method

- We build on earlier work in dropout prediction which has found success using clickstream features [3] and exhaustively train Random Forest models
- We apply Chi-Squared tests for proportion to examine differences in disengaging and re-engaging behavior
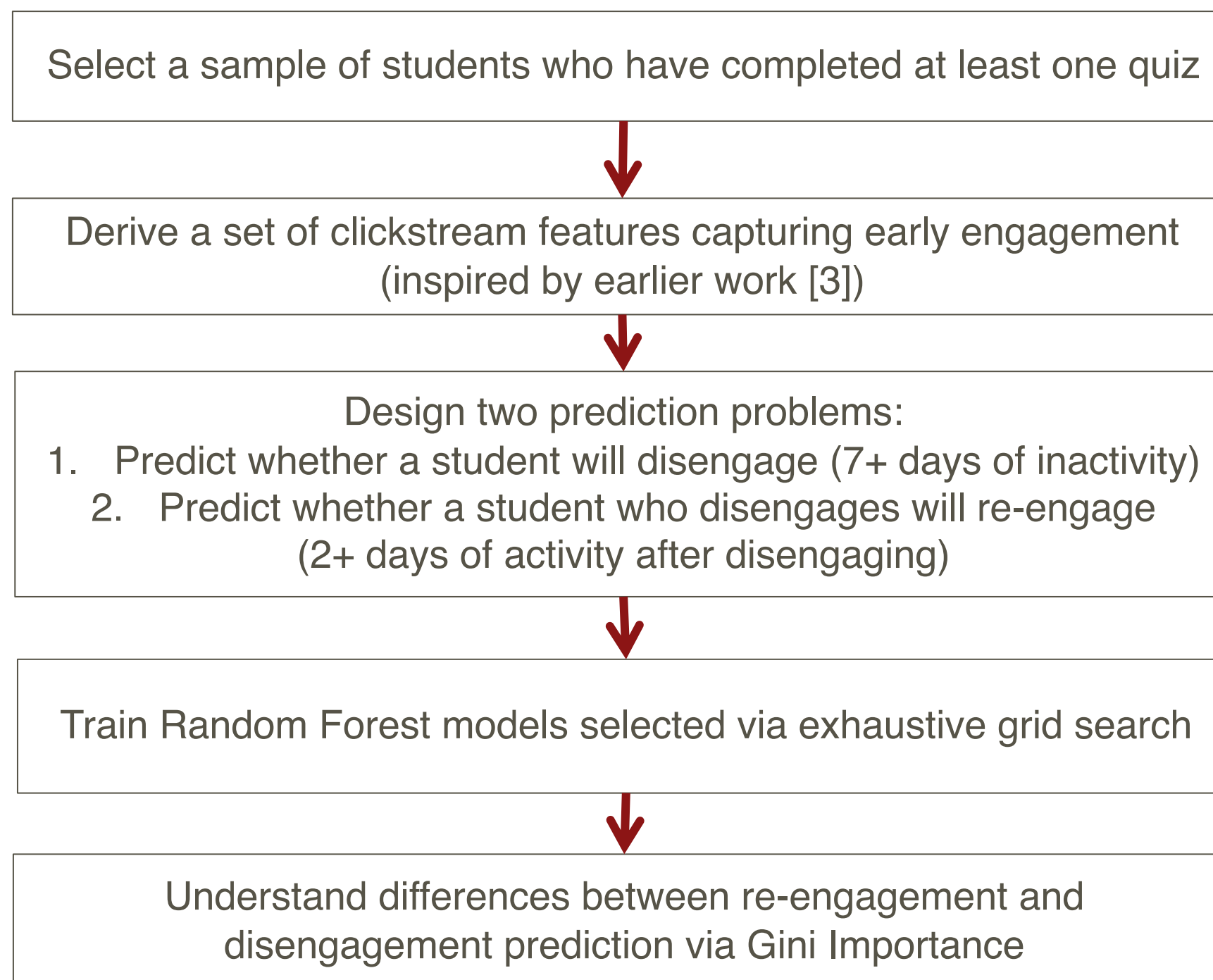
Implications and Future Work

- A significant amount of seemingly disengaging students re-engage with mobile learning, which can be predicted from early engagement
- Future work studying mobile learning should consider this context and cater to the strengths of mobile devices

Pipeline for modeling modes of engagement

Shupavu 291: A text message-based mobile learning platform widely used in Kenya

We examine activity from 87,651 students who log 21,302,582 platform interactions, including 1,196,780 quiz activities.

Select a sample of students who have completed at least one quiz

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Derive a set of clickstream features capturing early engagement (inspired by earlier work [3])

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Design two prediction problems:
1. Predict whether a student will disengage (7+ days of inactivity)
2. Predict whether a student who disengages will re-engage (2+ days of activity after disengaging)

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Train Random Forest models selected via exhaustive grid search

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Understand differences between re-engagement and disengagement prediction via Gini Importance

Daily student activity features for two days

Feature Name	Definition
time.i	Time spent on day i
nlessonsfinished.i	Num. of lessons completed on day i
nask.i	Num. of questions asked on day i
n_quizzes.i	Num. of quizzes completed on day i
avg_solve_time.i	Avg. time to complete quizzes on day i
n_unique_quizzes.i	Num. of unique quizzes completed on day i
nsummary.i	Num. of quiz results viewed on day i
nhw_tools.i	Num. homework tools (e.g. dictionary) used on day i

Key Results

- 72% of students disengage for a period of seven or more days
- Of disengaging students, **36% eventually re-engage**
- Re-engaging students interact significantly more with quizzes (56.0% v. 47.6%) and lessons (11.5% v. 10.3%)
- Students who remain disengaged have a larger proportion of registration events (13.3% v. 7.3%).
- We predict disengagement with an 81.21% F1-score and 83.06% Recall
- We predict re-engagement with an 80.91% F1-score and 84.19% Recall
- **Number of quizzes** completed, **time spent on day 1**, and **number of platform features** used are more important in predicting **re-engagement**

Feature importance organized by prediction problem
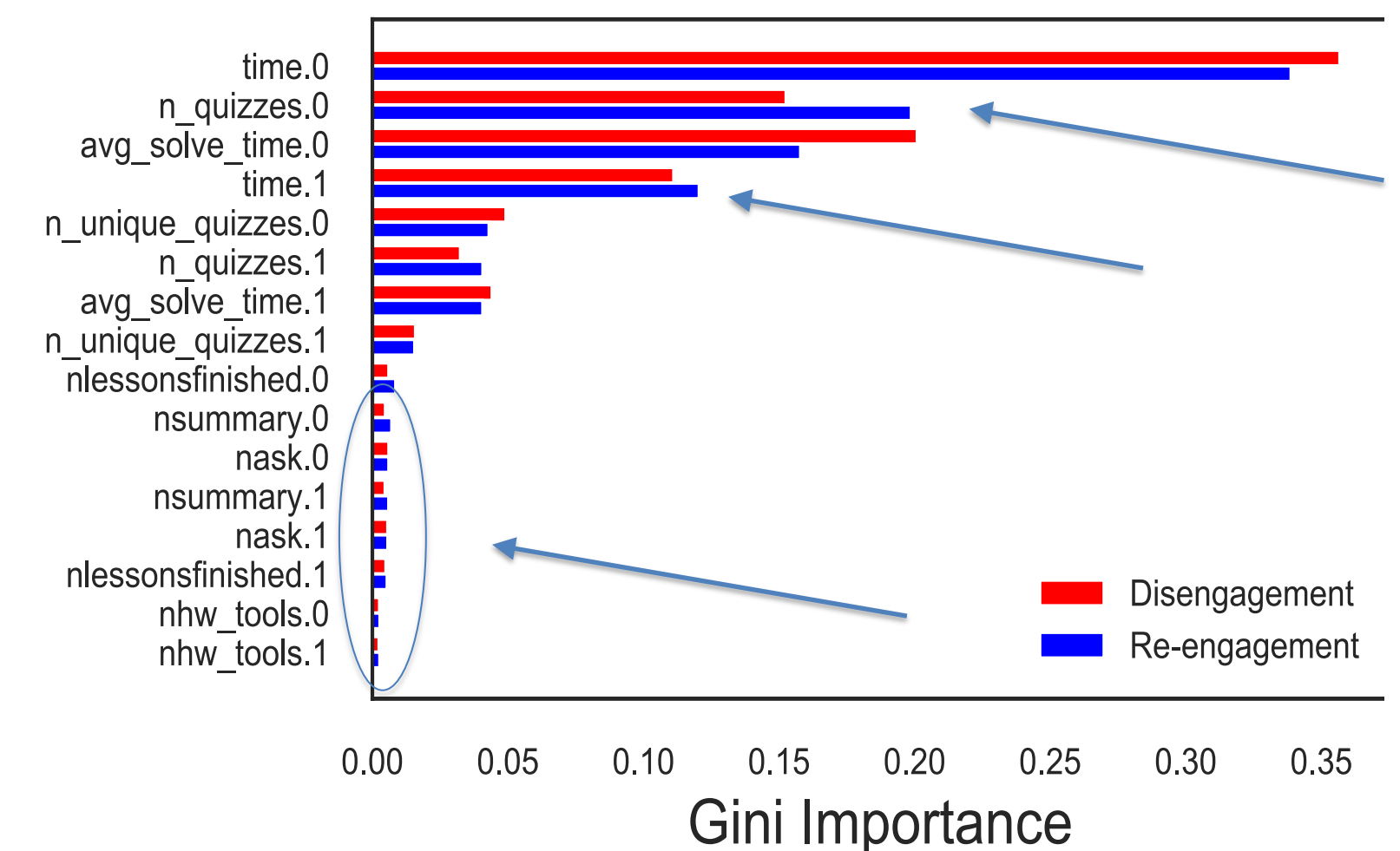
[1] R. Kizilcec and M. Chen. 2020. Student Engagement in Mobile Learning via Text Message. In Learning @ Scale.

[2] T. Dingler, D. Weber, M. Pielot, J. Cooper, C. Chang, and N. Henze. 2017. Language learning on-the-go: opportune moments and design of mobile microlearning sessions. In MobileHCI.

[3] C. Taylor, K. Veeramachaneni, and U. O'Reilly. 2014. Likely to stop? Predicting stopout in massive open online courses. Available on arXiv.