9-12 JUNE
STOCKHOLM 2019
GLOBAL PUBLIC TRANSPORT SUMMIT

Interactive Machine Learning for Commuters: Achieving Personalised Travel Planners through Machine Teaching

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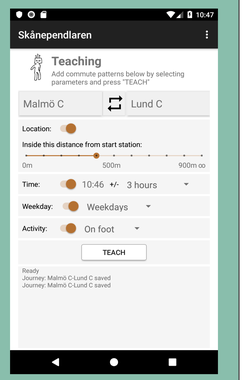
INTRODUCTION

Smartphone apps are an increasingly important part of public transport and can be seen as part of the travel experience. Personalisation of the app is one aspect of the experience that, for example, can give travellers a possibility to save favourite journeys for easy access. However, such a list of journeys can be extensive and inaccurate if it does not consider the traveller's context. Making an app context aware can transform the app experience in a personal direction, especially for commuters. By using historical personal contextual data, a travel app can present probable journeys or accurately predict and present an upcoming journey with departure times. The predictions can take place when the app is started or be used to remind a commuter when it is time to leave in order to catch a regularly travelled bus or train.

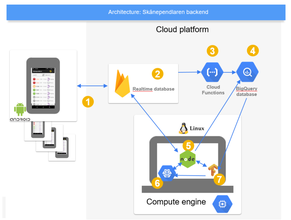
AIM

To investigate this we created an technological probe (an Android app) that implements the machine learning paradigm Machine Teaching [1,2]. In machine teaching the end user defines what the machine should learn. We used the contextual parameters weekday, time, activity and location as input so we can predict a user's upcoming journey. Predictions are made when the app starts and departure times for the most probable transport are presented to the commuter. In the work we present here, we mainly focus on how to teach the machine learning agent in an easy manner. Our aim is to give the commuter a possibility to initiate a machine teaching session at any time, add teaching data and evaluate the results of the prediction [2].

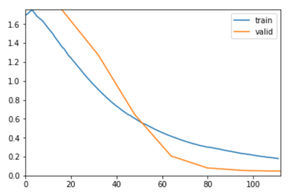


The machine teaching interface used in the study.

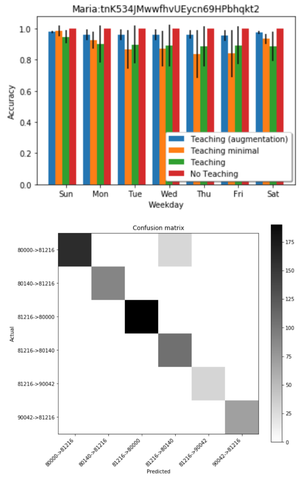
RESULT: DESIGNING FOR MACHINE TEACHING



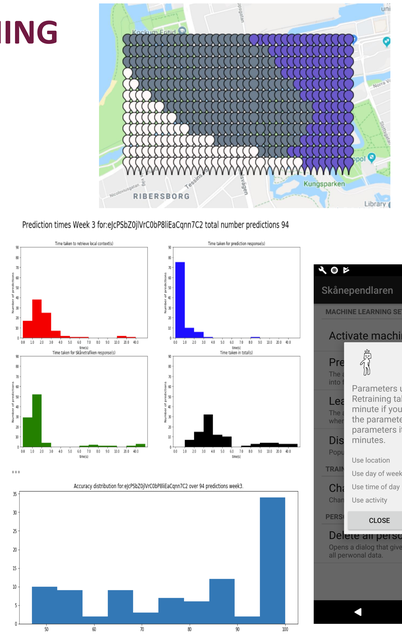
2	0.934742	1.273829	0.833333
3	0.617409	0.644295	0.900000
4	0.423758	0.205817	1.000000
5	0.304959	0.079827	1.000000
6	0.232880	0.052818	1.000000
7	0.179380	0.046892	1.000000



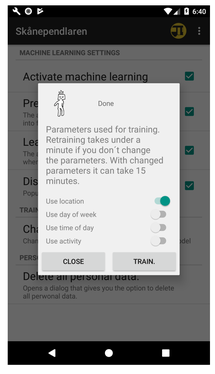
The backend was designed to fulfill basic metrics concerning prediction time, training time and accuracy.



Using three personas with different commute patterns we could create and evaluate realistic but fictive travel data.



By bringing the technological probe into the context and the hands of users we could study and evaluate the basic functionality in a real world setting. We presented visualisations of central metrics and discussed the existing user interface

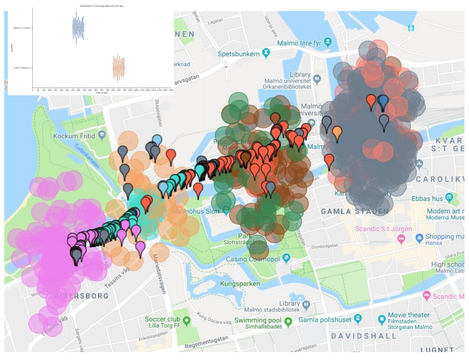


"If the app has no idea, that should be shown.."

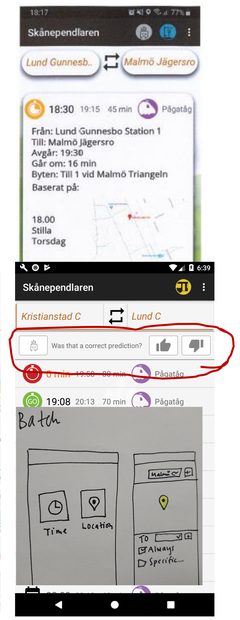
"I trained it at Monday morning and on the Tuesday it guessed the right journey"

"There should be a way to check what it knows.."

"I was more impressed in the beginning, but after a while I think it got confused of all the teaching."



The final result and conclusions are based on analysis of discussions with the participants in the CoDesign part of the study. In two final workshops alternative interactions and the need for visualisations of the teaching data was discussed.



Backend design → Feasibility study → User tests → Co-Design phase

CODESIGN

To investigate the area we used a Co-Design[3] process centered on an technological probe. The eight participants in the study had a mix of competences in graphic design, interaction design, agile development and computer science. Using the functioning technological probe, the participants in the study explored and took part in an ongoing design process with the goal of contributing with their individual expertise and perspective to the result of the study. The study spanned eight weeks with weekly meetings and two workshops.

In order to build the technological probe we evaluated different machine learning frameworks and cloud services. The goal was to reach acceptable metrics regarding basic functionality like accuracy, prediction times and model training. With those metrics in place the result was evaluated using data created for three fictive personas[4]. We then conducted real world tests within the development group and with the study participants to verify the functionality and that our metrics met our expectations.

CONCLUSIONS

With our setting, our study participants concluded that teaching a simpler commute patterns is easily done and will perform in an understandable way. It was seen as an viable alternative to favorite lists in travel apps if the predictions are instant. The study participants also concluded that with continuous teaching over time it can become hard to understand the logic behind the predictions. It then seems important that a user can assess and evaluate why a specific prediction was given.

There were, among the study participants, an discussion around if some of the learning could take place in a more interactive way and be triggered by new journeys as a complement to, as in our case, always be initiated by the user. For further work it would be interesting to investigate a more interactive approach.

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ACKNOWLEDGEMENTS

This work was partially financed by the Knowledge Foundation through the Internet of Things and People research profile.

K2 is Sweden's national center for research and education on public transport.

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