Machine learning for automated software testing

Background
My research will be conducted at Crosskey Banking Solutions. The company “develops, delivers and maintains systems and solutions for the Nordic bank and capital markets” (Crosskey.fi, 2014). This thesis is based around the general question of how software testing can be automated to a greater extent.

“Software testing is an empirical technical investigation conducted to provide stakeholders with information about the quality of the product or service under test” (Kaner, 2006). Manual software testing can be labor intensive and account for a large portion of the costs in software development projects. Therefore, automated software testing solutions can be very meaningful for companies they could save both time and money, especially when having the increasing complexity of software in mind.

One approach to automate software testing is machine learning, which has been studied both for testing graphical user interfaces (Choi, Necula and Sen, 2013) and for validating software functionality (Noorian, Bagheri and Du, 2011).

As the company is interested in automated software testing in general I think that it would be interesting to study the practical usefulness of an machine learning approach to this task in my thesis.

Research question(s)
My thesis research would build on the questions for further research as proposed by Noorian, Bagheri and Du (2011) who state that “some major questions remain that need to be addressed and further investigated such as:

- What types of machine learning methods can be effective in different aspects of software testing?
- What are the strengths and weaknesses of each learning method in the context of testing?
- How can we determine the proper type of learning method for the stages of a testing process?
- Where are the critical points in a software testing process in which ML can positively contribute?”
By trying to answer some of these sub questions my main research question could be formulated as: “Is machine learning a useful and practical approach for automating software testing for software development companies today (considering the current knowledge in machine learning)?” Alternatively I could also focus on only one of the four questions above.

These questions will be answered by a thorough literature review and state of the art analysis in the fields of machine learning and competing methods for (automated) software testing. Depending on the question, a program will be developed and tested with various machine learning approaches (based on the state of the art analysis) and other competing approaches (both automated and non automated). Experiments will be conducted to gather certain software testing metrics that can be used to compare the different methods which will be used as data for answering my research question.

My background

I am a student at the Industrial Engineering and Management Programme at KTH with a strong orientation towards computer science. I have taken courses in Java programming, web-technologies, low level programming and computer architecture and language technology to name a few. I have also taken a course in agile development that focused on testable and maintainable code.

The course in language technology introduced me to the field of machine learning which I find very interesting. Therefore, I chose to focus on machine learning in my bachelor thesis which is called “Twitter Sentiment Analysis by Applying Principles of Machine Learning” and was supervised by Carl Henrik Ek at KTH. The following is the abstract from the thesis:

“Sentiment analysis of “tweets” on Twitter has many interesting applications. For example, companies can get insights in their public image or how well a new product has been received by its users. Given the vast amounts of tweets that have to be analyzed to get a clear picture, an automated system would be very useful. In this paper we have explored how machine learning can be used to perform this task. More specifically, we have implemented a system that uses supervised machine learning to assess how well such an approach works for three class (positive, negative and neutral) sentiment classification of tweets. The implemented system performs with about double the accuracy that a random classification approach would result in. We found evidence in our results that suggest that certain preprocessing methods for tweets resulted in a better result for the implemented system.”
My supervisor

Daniel Eriksson at Crosskey Banking Solutions will be my supervisor. He is the team leader for the mobile team in the online banking department in the company and will arrange a space for me to work in with a company computer, introduce me to the team and other important staff and have regular meetings with me regarding my work for example.

Additional information

This thesis will be written in parallel with Andreas Wasberg who also is going to conduct his thesis at Crosskey Banking Solutions. He will, however, focus on the question how a large scale IT company can shorten its release cycles through the use of automated tests. I will be part of the mobile team at Crosskey. Hopefully we will learn from each other during our work. Naturally, research questions always change during the course of work and in this case it could partly be because of the mobile application context that I will work in.

References


