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Attn: Canadian Artificial Intelligence Association

Re: Outstanding MSc Thesis Award for Kurt Routley

Dear committee members:

It is my pleasure to nominate Kurt Routley for the CAIAC Outstanding MSc Thesis award.

Kurt has written an outstanding thesis on a very Canadian topic: the dynamics of ice hockey. His research combines powerful big data analytics techniques from computer science with advanced statistical modeling (Markov chains). Kurt wrote a program called a web crawler that downloads play-by-play data from the National Hockey League website and inserts the data into a relational database. The data comprise 14 NHL seasons, over 17,000 games and over 4 million events (hits, goals, penalties, faceoffs, shots, etc.). This dataset has been added to the SFU librarys Radar collection of research datasets.

From this massive dataset, Kurt's program constructs a sophisticated statistical model. In a nutshell, the model predicts what is likely to happen next given the current state of a match. This prediction takes into account a rich context describing the current state, which includes features such as the current score, game period, manpower advantage, and which actions have occurred before the current play. All in all, Kurts model includes over 1.3 million game states, meaning scenarios that have been observed in NHL play and that influence the next play in a match. This provides a very high-resolution picture of the game context, but raises serious computational challenges for managing and exploiting the high level of detail. Kurt has applied advanced computational techniques from the fields of Machine Learning and Artificial Intelligence to solve these challenges. While Kurt's initial version took 3 days to analyze his massive dataset to build a powerful statistical model, he improved it with advanced algorithms that decrease this time to less than 8 hours.

The main application of the hockey dynamics model in Kurt's thesis is scoring actions according to the impact they generally have on a game, and ranking players according to the impact of actions they take. Ranking players is a major concern of sports statistics. The approach of ranking players by the success of their actions is related to advanced hockey statistics such as Corsi and Fenwick, officially supported by the NHL. But Kurt's thesis offers a completely novel way to define such metrics, based on advanced concepts from Artificial Intelligence.

One of the major findings of Kurt's research is that the value of a hockey action depends

heavily on the context in which it is taken. For instance, taking the puck away from the opponent has the highest impact on goal scoring if it occurs in the neutral zone after winning a faceoff in the neutral zone. These findings are based on using the statistical model to simulate a large set of virtual random games following the observed hockey dynamics in the NHL. Kurt uses his work to produce extensive detailed rankings of players according to different criteria. For example, he finds bargain players that perform many actions in contexts where they tend to lead to goals and wins, yet draw only half the salary of players with similar impact. For another example, he finds that some stars earn their reputation by contributing to many goals, but also have a negative impact on their team by performing unusually many actions that lead to penalties. A paper based on Kurts thesis research has been accepted by the prestigious conference for Uncertainty in Artificial Intelligence (UAI).

Kurt has completed a technically very sophisticated thesis that combines computer science and statistics for an application of great interest to the media, the sports industry, and the general public. I believe that he is fully deserving of the award.

Sincerely,

T Swartz

Tim Swartz
Internal Examiner
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