OOKAMI PROJECT APPLICATION

Date: July 15, 2021

Project Title: Deep Learning Click and Recommendation Models for Supporting Complex Search Tasks

Usage: Testbed

Principal Investigator:

Dr. Jiqun Liu
School of Library and Information Studies
The University of Oklahoma
401 W. Brooks, Room 120
Norman, OK 73019-6032, USA
Phone: 732-447-7564
Email: jiqunliu@ou.edu

Names & Email of initial project users:

Ben Wang, benw@ou.edu

Usage Description:

This project proposes to use deep learning methods to develop neural click models and recommender algorithms, which partially support the first-stage work of our NSF project: A Bias-Aware Approach to Modeling Users in Interactive Information Retrieval. In our NSF project, there are three stages requiring machine learning methods and corresponding computing resources:

(1) We will first extract bias-aware features from user behaviors and explicit feedbacks in a controlled lab study. These bias-aware features can help us develop click models with some traditional machine learning methods, such as Logistic Regression, Random Forest, XGBoost, and Support Vector Machine. With small-size datasets, the training and testing processes on the first stage require low node hours per job but need to repeat for more times on Ookami.

(2) Second, we will implement machine learning methods on data collected from a naturalistic study. The data collected over a long period can reflect a user's search behavioral patterns, and we will also consider semantic features from documents and result snippets. Therefore, we plan to employ deep neural network models, such as long short-term memory (LSTM) and Deep Interest Network (DIN), to extract users' dynamic search interests, and natural language processing methods, such as BERT, to extract patterns of users' implicit states from their queries and the webpage contents. At this stage, we will require more computing resources to test and update our models on Ookami.

(3) For the last stage, we will develop recommendation algorithms and simulate users based on the knowledge learned from user studies. Our tentative plan is to simulate a user agent and a system agent respectively and model the dual-agent interaction process in

simulated task environments. Based upon the set of user states, possible behavioral patterns and available "moves" from system, we will train a deep reinforcement learning algorithm that can approximate the optimal policy for providing right recommendations (e.g. queries, ranked document and item lists, search paths) at the right time (i.e. state). The model performances will be evaluated using classical evaluation metrics, including precision, recall and normalized discounted cumulative gain (nDCG).

The requested testbed project will allow us to train and test sophisticated click and ranking models more effectively and contribute to the advance in bias-aware modeling in both information retrieval and recommender system fields. Our future research publications developed based on the testbed project will properly acknowledge the computing resource support from Ookami.

Computational Resources:

Total node hours per year:	8000
Size (nodes) and duration (hours) for a typical batch job:	1 – 4 nodes, 4 – 20 hours
Disk space (home, project, scratch):	home: 30 GB (default) project: 1 TB (default)

Personnel Resources (assistance in porting/tuning, or training for your users):

User training

Required software:

Anaconda3, Python3 and related libraries, TensorFlow

If your research is supported by US federal agencies:

Agency: National Science Foundation
Grant number(s): 2106152
Link to the public facing abstract of the award at here:
https://www.nsf.gov/awardsearch/showAward?AWD_ID=2106152&HistoricalAwards=false