Software Engineering Laboratory

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The main directions in research conducted by the Software Engineering Lab members were

- Semantic Methods for Information Retrieval,
- Technologies for Internet Applications
- Computer Security
- Intelligent Systems and Learning Technologies

Prof. Klyuev leads the Semantic Methods for Information Retrieval, Technologies for Internet Applications, and Computer Security directions. The focus of the research by Prof. Hamada is on Intelligent Systems and Learning Technologies.

Semantic Methods for Information Retrieval

In the areas involving data relatedness analysis and big data processing (such as information retrieval and data mining) one of common ways to test developed algorithms is to deal with their software implementations. Deploying software as services is one of possible ways to support better access to research algorithms, test collections and third party components as well as their easier distribution. . As a part of knowledge driven approach to provisioning CLI software in clouds we introduce a novel subject domain ontology which is purposed to describe and support processes of software building, configuration and execution. We pay special attention to the process of fixing recoverable build and execution errors automatically. We study how ontologies targeting specific build and runtime environments can be defined by using the software provisioning ontology as a conceptual core. We examine how the proposed ontology can be used in order to define knowledge

base rules for an expert system controlling the process of provisioning applications to computing clouds and making them accessible as web services. This research was done in tight cooperation with our colleagues from Polytechnic State University, Russia and Motorola Solutions Inc. Its results were presented at the 10th International Workshop Databases in Networked Information Systems.

Our students were involved in a project to improve the reliability of hotel ranking by detecting and deleting outlier on-line reviews. Results were presented at the iCAST 2014 International Conference.

Accuracy of Compound Noun Detection in Japanese is crucial to elevate the intelligent of the retrieval. This project also attracted attention of the lab students. Results of this study were presented at the FutureTech 2014 Conference.

Technologies for Internet Applications

Application running on the Web is the main trend in Software Engineering. The Go language and the tools related to it were in the focus of the study in 2014 AY. Interest of the lab students to this topic was the key factor to do this research. Results of the investigations conducted together with the students were presented at The 4th IEEE International Conference on Information Science and Technology and the 2nd International Conference on Internet Computing & Information Services.

Computer Security

Intelligent DDoS Attack Detection methods were studied by lab students. Their enthusiastic work resulted in successful presentation of the obtained results at The 9th International Conference for Internet Technology and Secured Transactions.

Intelligent Systems and Learning Technologies

Prof. Hamada continued his research on intelligent systems and learning technologies. He and his students work in developing intelligent learning system (ITS). ITSs aim to provide immediate and customized instruction or feedback to learners, usually without direct intervention from a human tutor. ITSs have the common goal of enabling learning in a meaningful and effective manner by using a variety of computing technologies. There are many examples of ITSs being used in both formal learning and professional settings in which they have demonstrated their capabilities and limitations. There is a close relationship between intelligent tutoring, cognitive learning theories and design; and there is ongoing research to improve the effectiveness of ITS. Areas that have used ITS include natural language processing, machine learning, planning, multi-agent systems, ontologies, semantic Web, and social and emotional computing. In addition, other technologies such as multimedia, object-oriented systems, modeling, simulation, and statistics have

also been connected to or combined with ITS. In recent years, ITS have expanded across many critical and complex cognitive domains, and the results have been far reaching. ITS systems have cemented a place within formal education and these systems have found homes in the sphere of corporate training and organizational learning. ITS offers learners several affordances such as individualized learning, just in time feedback, and flexibility in time and space. While Intelligent tutoring systems evolved from research in cognitive psychology and artificial intelligence, there are now many applications found in education and in organizations.

In 2014 AY, Prof. Hamada and his team published one book and 7 scientific papers in journals and conference proceedings published by major publishers such as ACM, IEEE, Elsiver, etc.

International Relations

Invited lectures and grants

Prof. Hamada organized an invited lecture on MOOC (Massive Open Online Course) by Prof. Paul B. from Stanford University. Prof. Hamada was invited as a visiting Prof. at Fatih University, Istanbul Turkey for 3 months from March to May 2014. His research during this visit was funded by Istanbul foundation. In August 2014, he was invited as a visiting Prof. at the African University of Science and Technology, Abuja, Nigeria. His research during this visit was supported by a grant from the Word Bank. In Sept. 2014, Prof. Hamada was invited as a visiting Prof. at Cairo University, Cairo Egypt.

International conferences and workshops

Our lab in cooperation with the Active Knowledge Lab organized the 3rd International Workshop on Advances in Semantic Information Retrieval as an event of the 2014 Federated Conference on Computer Science and Information Systems (Poland, 2014). We involved in this activity since 2011. This workshop is gained popularity among researchers from Europe and Asia.

Since 2014, we have been running The International Workshop on Applications in Information Technology. The workshop is organized in cooperation with the Active Knowledge Lab.

This event is a place for the first scientific presentations of the best students of the University of Aizu and our partner universities. This workshop is a good school for Japanese and foreign students on their way to become scientists. The Workshop on Applications in Information Technology discovers new names of the next generation of scientists. This workshop creates the necessary conditions to keep international scientific contacts at the student level. We do hope, some of students participating in this workshop will work in tight cooperation in the future. Some visitors published their impressions on results of participation in

our event. Ms. Irina Skudnova published her story entitled 典 rip to the Workshop Applications in Information Technology, Japan, October, 2014, available at: http://www.apmath.spbu.ru/ru/education/international/international32.html

Prof. Hamada organized and chaired an International Workshop on Cloud Computing-based e-Learning Systems (CCLS) from Sept. 23 to 25, 2014. CCLS was held in conjunction with the IEEE MCSoC that takes place at University of Aizu.

Exchange of Undergraduate Students

Undergraduate university student Mr. Akama visited Saint Petersburg State University, Russia in April 2014 and presented his paper at the XLV Conference on Control Processes and Stability. Our Russian partners covered local expenses during the his stay in Saint-Petersburg.

In autumn, we welcomed Ms. Irina Skudnova at our The International Workshop on Applications in Information Technology. Her local expenses during her stay in Aizu were covered by our university.

Foreign Students

Mr. Hsien-You Hsieh, master DDP student from Chaoyang University of Technology, Taiwan, successfully graduated in autumn 2014.

A DDP is a system where students can earn two degrees, from the home and the partner university through mutual recognition of credits attained at the universities, and the goal of the program includes fostering excellent human resources educated internationally, as well as strengthening relations between partner universities through concrete exchanges. The Memorandum of Understanding establishing the international dual degree program for students of our university and Chaoyang University of Technology was concluded in 2009.

This is the third time when our lab welcomes the student from Chaoyang University of Technology.

Achievements

This year, for the second time in the history of Software Engineering Lab, papers of undergraduate students Mr. Kato and Mr. Makino were accepted for presentations at two high rank conferences. They will appear in the prestigious proceedings published by IEEE. These papers discuss the results of undergraduate research of these students.

Prof. Hamada published the Java Learning App in Apple App Store and it is available for free download for the benefits of our students and all Java learners worldwide. In a few weeks after the App publication, there was more than 2000 downloads by Java learners from more than 80 countries worldwide.

Other activities

Prof. Hamada is a regular Guest Researcher at the Arena center, Tsukuba University.

Prof. Hamada awarded the IEEE senior membership.

Refereed Proceeding Papers

[hamada-01:2014] A. Tabot and M. Hamada. The Role of Multimedia Learning Systems in the Nigerian Higher Educational Landscape. In *IEEE ITHET*, pages 91–97, New York, Dec. 2014. “ IEEE ”, “ IEEE ”.

The paper discusses the role and effect of applying multimedia learning systems in the Nigerian higher educational landscape.

[hamada-02:2014] A. Tabot and M. Hamada. Mobile Learning with Google App Engine. In *IEEE MCSoC*, pages 63–67, New York, Dec. 2014. “ IEEE ”, “ IEEE ”.

The paper introduces framework for mobile learning using Google App Engine as smart platform.

[hamada-03:2014] K. Tufan A. Ali and M. Hamada. A Multimedia Mobile-based Learning Framework for Kurdish Language. In *IEEE ITHET*, pages 112–118, New York, “ August. ” 2014. “ IEEE ”, “ IEEE ”.

The paper introduces a multimedia learning system and utilizes artificial intelligence techniques for learning natural languages taking the Kurdish language as an example. ”,

[hamada-04:2014] Mohamed Hamada A. Ali and K. Tufan. Smart Cloud-based Implementation of a Learning Style Index. In *IEEE MCSoC*, pages 68–74, New York, “ SEPT ” 2014. IEEE, IEEE.

The paper introduces a smart cloud based implementation of a developed learning style index aiming to measure the learners performance ”,

[hamada-05:2014] C. Prettenthaler M. Ebner and M. Hamada. Cloud-based service for eBooks using EPUB under the Aspect of Learning Analytics. In *IEEE MCSoC*, pages 116–122, New York, Dec. 2014. “ IEEE ”, “ IEEE ”.

The paper introduces framework for mobile learning using Google App Engine as smart platform.

[vkluev-01:2014] Vitaly Klyuev Motoki Miyashita. TermExtract: Accuracy of Compound Noun Detection in Japanese. In Gaggy Lee, editor, *Future Information Technology, Lecture Notes in Electrical Engineering*, volume 309, pages 189–194. Springer, May 2014.

Term recognition in the Japanese language is known as one of the challenging problem in natural language processing and information retrieval. We often

use morphological analyzers to process Japanese documents. These tools usually do not recognize compound nouns. These nouns are combinations of single nouns expressing different meaning compared to basic nouns. Morphological analyzers usually separate compound nouns into single nouns. Therefore reconstructing compound nouns is essential to preserve text semantics. There is a tool called TermExtract to do the aforementioned reconstruction. In this study we evaluate its accuracy. To identify terms created by TermExtract, online resources are utilized. They are the ALC online dictionary, Wikipedia and Google phrase search service. Experiments are conducted with abstracts of scientific documents from the NTCIR-1 collection. We found that TermExtract is able to reconstruct 36.23of all compound nouns in the corpus. Most of these nouns belong to scientific terminology.

[vkluev-02:2014] Vitaly Klyuev Naohiro Togashi. Concurrency in Go and Java: Performance Analysis. In *The 4th IEEE International Conference on Information Science and Technology (ICIST)*, number DOI: 10.1109/ICIST.2014.6920368, pages 213–216. IEEE, April 2014.

Go is a new programming language developed by Google. Although it is still young compared to other programming languages, it already has modern and powerful features inherited from existing programming languages, and some of these are similar to Java. Go is designed for quick time development. Concurrency is the one of the main its features. In this paper, we analyze the performance of Go, and compare it with Java from two aspects: compile time and concurrency. There are many studies about the performance analysis and comparison of programming languages, but only a few publications investigate Go. Some of Go performance evaluation are based on the experimental release of Go. To analyze concurrency features, we implement simple matrix multiplication programs in both Go and Java. Java implementation uses Java Thread, and Go implementation uses Gor-outine and Channel. From the experiment, Go derived better performance than Java in both compile time and concurrency. Moreover, Go code shows the ease of concurrent programming. Go is still young, but we are convinced that Go will become the mainstream.

[vkluev-03:2014] Qiangfu Zhao Shih-Hung Wu Hsien-You Hsieh, Vitaly Klyuev. SVR-based outlier detection and its application to hotel ranking. In *2014 IEEE 6th International Conference on Awareness Science and Technology (iCAST)*, number DOI: 10.1109/ICAwST.2014.6981842, pages 1–6. IEEE, October 2014.

With the rapid advance in information technology, more and more information

exchange platforms appear. People can freely exchange information on these platforms. However, not all information is reliable. To make correct decisions, it is necessary to detect and remove unreliable information. The main purpose of this study is to improve the reliability of hotel ranking by detecting and deleting outlier on-line reviews. For this purpose, we design a support vector regression (SVR) based outlier detector using existing on-line reviews. Intuitively, normal reviews are regular, and can be correctly labeled by the SVR detector. Outlier reviews, on the other hand, are usually not regular, and cannot be correctly labeled. Thus, a well-designed SVR-detector can help us to delete outlier reviews automatically. Results obtained in this study are useful not only for hotel ranking. In principle it can be good for recommendation of any services.

[vkluev-04:2014] Vitaly Klyuev Ivan Khozyainov, Evgeny Pyshkin. Understanding Software Provisioning: An Ontological View. In *Databases in Networked Information Systems. Lecture Notes in Computer Science*, volume 8999, pages 84–111. Springer, Springer, March 2015.

In the areas involving data relatedness analysis and big data processing (such as information retrieval and data mining) one of common ways to test developed algorithms is to deal with their software implementations. Deploying software as services is one of possible ways to support better access to research algorithms, test collections and third party components as well as their easier distribution. While provisioning software to computing clouds researchers often face difficulties in process of software deployment. Most research software programs utilize different types of unified interface; among them there are many desktop command-line console applications which are unsuitable for execution in networked or distributed environments. This significantly complicates the process of distributing research software via computing clouds. As a part of knowledge driven approach to provisioning CLI software in clouds we introduce a novel subject domain ontology which is purposed to describe and support processes of software building, configuration and execution. We pay special attention to the process of fixing recoverable build and execution errors automatically. We study how ontologies targeting specific build and runtime environments can be defined by using the software provisioning ontology as a conceptual core. We examine how the proposed ontology can be used in order to define knowledge base rules for an expert system controlling the process of provisioning applications to computing clouds and making them accessible as web services.

[vkluev-05:2014] Vitaly Klyuev Keisuke Kato. Large-scale Network Packet Analysis for Intelligent DDoS Attack Detection Development. In *The 9th International Conference for Internet Technology and Secured Transactions (ICITST-2014)*, number DOI: 10.1109/ICITST.2014.7038838, pages 360–365. IEEE, IEEE, December 2014.

Distributed Denial of Service (DDoS) attacks are a serious threat to network security. Servers of many companies and/or governments have been victims of such attacks. DDoS attacks jam the network service of the target using multiple bots hijacked by crackers and send numerous packets to the target server. In such an attack, detecting the crackers is extremely difficult, because they only send a command by multiple bots from another network and then leave the bots quickly after command execute. Therefore, we need an intelligent detection system for DDoS attacks to defend network services. To develop the system, we utilized machine learning techniques to study the patterns of DDoS attacks and detect them. We analyzed large numbers of network packets provided by the Center for Applied Internet Data Analysis, and detected some important patterns that affect the accuracy of the detection system. We implemented the detection system using the patterns of DDoS attacks. A support vector machine with the radial basis function (Gaussian) kernel is its core part. The detection system is accurate in detecting DDoS attacks.

[vkluev-06:2014] V. Klyuev M. Hoshi. Questionnaire generator: Web application using cloud computing. In *E-Commerce, E-Business and E-Service*, pages 121–125. CRC Press, May 2014.

There are many ways to develop Web applications. This paper focuses on Google App Engine with Java. We present a questionnaire application using Google App Engine. We discuss the key technologies used and de-tails of algorithms implemented. We demonstrate the preliminary results of the evaluation of the application created.

Grants

[hamada-06:2014] “ Abo H. and Mohamed Hamada. “ Cairo University Grant, Cairo, Egypt ”, 2014 ”,.

[hamada-07:2014] Mohamed Hamada and Kadir Tufan. Fatih University Grant, Istanbul, Turkey, 2014 ”,.

[vkluev-07:2014] V. Klyuev. Summarization of Wikipedia Articles, Competitive Grant, University of Aizu, 2014.

Academic Activities

[hamada-08:2014] Mohamed Hamada, April 2014 ” ,.

Senior Member.

[hamada-09:2014] Mohamed Hamada, April 2014 ” ,.

Senior member.

[vkluev-08:2014] V Klyuev, Apr. 2014.

Member

Ph.D and Others Theses

[hamada-10:2014] Takaya Onoda. Automata Simulator based on iOS Systems, University of Aizu, 2014.

Thesis Advisor: M. Hamada

[hamada-11:2014] Ippei Tomura. a Promotional App for University of Aizu, University of Aizu, 2014.

Thesis Advisor: M. Hamada

[hamada-12:2014] Shigeaki Kakinuma. C Language: A Programming Learning App, University of Aizu, 2014.

Thesis Advisor: M. Hamada

[hamada-13:2014] Shun Yamashita. Introduction App for Aizuwakamatsu City, University of Aizu, 2013.

Thesis Advisor: M. Hamada

[hamada-14:2014] Takuma Abe. An iOS-based Multimedia Learning System for Technical Japanese, University of Aizu, 2014.

Thesis Advisor: M. Hamada

[vkluev-09:2014] Hsien-You Hsieh. Master Thesis: SVR-Based Online Review Filtering and Its Application to Hotel Ranking, University of Aizu, September 2014.

Thesis Advisors: Vitaly Klyuev and Qiangfu Zhao

[vkluev-10:2014] Keisuke Kato. Large-scale Network Packet Analysis for Intelligent DDoS Attack Detection Development, University of Aizu, March 2015.

Advisor: Klyuev, V

[vkluev-11:2014] Yuma Makino. Evaluation of Web Vulnerability Scanners, University of Aizu, March 2015.

Advisor: Klyuev, V