

Software Engineering Laboratory



Mohamed Hamada
Senior Associate Pro-
fessor



Vitaly V. Klyuev
Senior Associate Pro-
fessor

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

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

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

Semantic Methods for Information Retrieval

Social networks influence the people's life. The power of social networks is not clearly understood by the government and scientists. The early detection of antisocial behavior (ASB) in written language is an urgent problem in text mining. In our joint project with colleagues from the University of Eastern Finland, we searched for linguistic features that pertain to ASB in order to use those features for the automatic identification of ASB in text. Results of this research are published in the Informatica journal and presented at the Federated Conference on Computer Science and Information Systems (Poland, 2013).

Another topic of our research was on investigation of main problems in opinion mining and sentiment analysis systems development. This research was done in tight cooperation with our colleagues from Polytechnical State University, Russia. Its results were presented at the 2013 International Joint

Conference on Awareness Science and Technology & Ubi-Media Computing (iCAST 2013 & UMEDIA 2013).

We successfully continued our joint project on semantic relatedness measures with Prof. Yannis Haralambous from Institute Telecom Bretagne, France. Obtained results were published in the International Journal of Computational Linguistics and Applications.

Computer Security

A computer security area attracted attention of our students. Password protection issues and learning technologies to protect data stored on computers were under our investigation. The results were presented at the following conferences: The 7th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (Germany, 2013), the XLIV Conference on Control Processes and Stability (Russia, 2013). A paper was accepted for publication in the International Journal of Computing.

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 cog-

nitive psychology and artificial intelligence, there are now many applications found in education and in organizations. In 2013 AY, Prof. Hamada and his team published one book and 10 scientific papers in journals and conference proceedings published by major publishers such as ACM, IEEE, Elsevier, etc.

International Relations

This year, the University of Aizu celebrated the 20th anniversary of its founding in April of 1993. In commemoration of this occasion, several scientific events were organized. One of them was The 2013 Competitive Learning Workshop as a part of The 2013 ACM-ICPC Asia Aizu Regional Contest. We were in charge for organizing this workshop. Coaches of world leading student team were invited to share their experiences. Our guests were Prof. Jan Madey, the University of Warsaw, Prof. Vladimir Kotov, Belarus State University, Prof. Vitaly Bondarenko, the Taras Shevchenko National University of Kyiv, and Prof. Tomoyuki Kaneko, the University of Tokyo.

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 2013 Federated Conference on Computer Science and Information Systems (Poland, 2013). We involved in this activity since 2011. This workshop is gained popularity among researchers from Europe and Asia. Selected papers from this workshop were published in the Special issue of the *Informatica* journal in January 2014.

Prof. Hamada was invited as a visiting Prof. at Fatih University, Istanbul Turkey for 3 months from March to May 2013. His research during this visit was funded by Istanbul foundation. In September 2013, 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 World Bank. In November 2013, Prof. Hamada was invited as a visiting Prof. at Cairo University, Cairo Egypt.

Exchange of Undergraduate Students

Our undergraduate students Mr. Makino and Mr. Togashi visited Saint Petersburg State University, Russia in April 2013 and presented their paper at the XLIV Conference on Control Processes and Stability. Our Russian partners covered local expenses during the stay of our students in Saint-Petersburg.

Foreign Students

Mr. Hsien-You Hsieh, master student from Chaoyang University of Technology, Taiwan, was enrolled in the dual-degree program (DDP) in autumn 2013.

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 first time in the history of Software Engineering Lab, papers of three undergraduate students Mr. Togashi, Mr. Hoshi, and Mr. Miyashita were accepted for presentations at three high rank conferences. They will appear in the prestigious proceedings published by IEEE, and Lecture Notes published by Springer, and proceedings published by Taylor & Francis Group. These papers discuss the results of undergraduate research of these students.

Other activities

Prof. Hamada is a regular Guest Researcher at the Arena center, Tsukuba University. Prof. Hamada awarded the ACM senior membership.

Refereed Journal Papers

- [hamada-01:2013] Mohamed Hamada. Turing Machine and Automata Simulators. *Periodica Computer Science*, 2013(1):1466–1474, 2013.

In this paper, a dissection on Turing machines and its applications was given. Simulators of several automata and TM was introduced.

- [vkluev-01:2013] T. Kakkonen E. Sutinen M. Mozgovoy V. Klyuev M. Munezero, C.S. Montero. Automatic Detection of Antisocial Behaviour in Texts. *Informatica*, 38(1):3–10, 2014.

A considerable amount of effort has been made to reduce the physical manifestation of antisocial behaviour (ASB) in communities. However, the key to the early detection of ASB is, in many cases, in observing its manifestations in written language which has not been studied in detail. In this work, we search for linguistic features that pertain to ASB in order to use those features for the automatic identification of ASB in text. We use an ASB text corpus we have collected as a machine learning resource and approach the detection of ASB in text as a binary classification problem where discriminating features are taken from the linguistic representation of the text in the form bag-of-words and ontology-based emotion descriptors. Results from experiments show that by exploiting the emotional information together with Bag-of-Words (BoW) over 90% accuracy in the classification of ASB in text is reached. Our findings have positive implications in the early detection of potentially harmful behaviour.

- [vkluev-02:2013] Yannis Haralambous and Vitaly Klyuev. Thematically Reinforced Explicit Semantic Analysis. *International Journal of Computational Linguistics and Applications*, 4(1):79–94, 2013.

We present an extended, thematically reinforced version of Gabrilovich and Markovitch's Explicit Semantic Analysis (ESA), where we obtain thematic information through the category structure of Wikipedia. For this we first define a notion of categorical tfidf which measures the relevance of terms in categories. Using this measure as a weight we calculate a maximal spanning tree of the Wikipedia corpus considered as a directed graph of pages and categories. This tree provides us with a unique path of most related categories between each page and the top of the hierarchy. We reinforce tfidf of words in a page by aggregating it with categorical tfidfs of the nodes of these paths, and define a thematically reinforced ESA semantic relatedness measure which is more robust than standard

ESA and less sensitive to noise caused by out-of-context words. We apply our method to the French Wikipedia corpus, evaluate it through a text classification on a 37.5 MB corpus of 20 French newsgroups and obtain a precision increase of 90% compared with standard ESA.

- [vkluev-03:2013] Keisuke Kato and Vitaly Klyuev. Password Protection: End User Security Behavior. *International Journal of Computing*, page forthcoming publication, 2014.

Password authentication is one of essential services in our life for protecting data. In other words, we may lose a lot of money, sensitive data, etc., if passwords leak out. Thus, we have to understand clearly what is important for creating and/or changing passwords. Our goal is to analyze key issues for setting passwords. We surveyed 262 students of the University of Aizu, Japan. We discussed key security problems, main password protection issues and techniques, and misunderstandings about passwords by end users. Furthermore, we compared the obtained data with results provided by the National Institute of Standard Technology (NIST) and others. The results can help the users set stronger passwords.

Refereed Proceeding Papers

- [hamada-02:2013] Hazem El-Bakry and Mohamed Hamada. A Fast diagnosing of pediatric respiratory diseases by using high speed neural networks. In *IEEE IJCNN*, page 18, New York, August 2013. IEEE, IEEE.

The paper utilizes high speed neural networks to introduce a fast diagnoses of pediatric respiratory diseases

- [hamada-03:2013] Mohamed Hamada and Takahiro Mitsui. A Mobile-based Multimedia System for Learning Japanese. In *ACM MoMM*, pages 369–375, New York, Dec. 2013. ACM, ACM.

The paper introduces a multimedia learning system and utilizes artificial intelligence techniques for learning Japanese language.

- [hamada-04:2013] Kiemute Oyibo and Mohamed Hamada. A Framework for Instantiating Native Mobile Multimedia Learning Applications on Android Platform. In *ACM MoMM*, pages 589–595, New York, Dec. 2013. ACM, ACM.

The paper introduces a multimedia framework as learning system for for smartphone platforms.

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- [vkluev-04:2013] Klyuev V. Makino Y. Web security learning technique for novices. In *Proceedings of XLIV Conference on Control Processes and Stability (CPS'13)*, pages 517–521, Russia, April 2013. Saint-Petersburg State University, Saint Petersburg State University Publishing Press.

In recent years, the crime using the brittleness of Web applications is increasing. Therefore, the necessity of information security education is becoming more important. Although there were the practical study methods also in the education for beginners, there was no study method with emphasis on management. We discuss a new technique to learn web security by using AppGoat and iLogScanner for the novice developers. Beginners can learn two important topics. One is the importance of checking the logs all of the time. And the other is the feature of a log when the application is attacked. AppGoat is a platform independent environment to learn vulnerability. iLogScanner is a tool to find attack to vulnerability easily by analyzing access log or error log on a web server.

- [vkluev-05:2013] Klyuev V. Togashi N. Comparison of Go and Java features. In *Proceedings of XLIV Conference on Control Processes and Stability (CPS'13)*, pages 528–532, Russia, April 2013. Saint-Petersburg State University, Saint Petersburg State University Publishing Press.

In this paper, we compare Go and Java focusing on their features.

- [vkluev-06:2013] Vitaly Klyuev Ivan Khozyainov, Evgeny Pyshkin. Spelling Out Opinions: Difficult Cases of Sentiment Analysis. In *2013 International Joint Conference on Awareness Science and Technology & Ubi-Media Computing (iCAST 2013 & UMEDIA 2013)*, number DOI: 10.1109/ICAwST.2013.6765439, pages 231–237. IEEE, IEEE, November 2013.

In recent years there is growing interest to the opinion mining applications in numerous areas of information and social science. In this paper we investigate main problems in opinion mining and sentiment analysis systems development. We review examples of difficulties in process of opinion extraction and introduce essential multidimensionality of opinion mining. We carried out a series of experiments with different sentiment analyzers and classified main reasons of incorrect sentiment recognition.

- [vkluev-07:2013] Vitaly Klyuev Keisuke Kato. Strong Passwords: Practical Issues. In *the 2013 IEEE 7th International Conference on Intel-*

ligent Data Acquisition and Advanced Computing Systems: Technology and Applications, volume 2, pages 608–613. IEEE, IEEE, September 2013.

Nowadays, there are a lot of news about hacking attacks over the Internet against companies and government organization Web sites in the world. Victims are big companies such as Evernote, Facebook, Google and others. Web server providers understand that the current authentication systems and passwords should be strong. The end users who are not specialists in the security should understand how to select strong passwords. Now, however, there is no ideal way to set a strong password. Most of the users don't know important elements for password protection. In this paper, we analyze the tendencies in the password protection. We survey 262 students of the University of Aizu. A questionnaire consists of 15 questions about length of a password, strategy to create a new password and etc. We discuss useful techniques to create strong passwords and compare them. Our analysis is based on our data and the state of the art literature review. Our results can be helpful for the users to create a new password and/or change it and make it strong.

[vkluev-08:2013] Tuomo Kakkonen Vitaly Klyuev Erkki Sutinen Myriam Munezero, Maxim Mozgovoy. Antisocial Behavior Corpus for Harmful Language Detection. In *2013 Federated Conference on Computer Science and Information Systems*, pages 261–265. IEEE, September 2013.

We report on experiments that demonstrate the relevance of our Anti-Social Behavior (ASB) corpus as a machine learning resource to detect antisocial behavior from text. We first describe the corpus and then, by using the corpus for training machine learning algorithms, we build a set of binary classifiers. Experimental evaluations revealed that classifiers built based on the ASB corpus produce reliable classification results with up to 98% accuracy.

Books

[hamada-05:2013] Mohamed Hamada. *E-Learning: New Technology, Applications and Future Trends*. Number 5. Nova Science Publishing, New York, 2013.

[hamada-06:2013] Mohamed Hamada. *Active and Collaborative Learning*:

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theory and practice. Number 6. Nova Science Publishing, New York, 2013.

Grants

[hamada-07:2013] Mohamed Hamada and Kadir Tufan. Fatih University Grant, Istanbul, Turkey, 2013.

Academic Activities

[hamada-08:2013] Mohamed Hamada, April 2013.

Senior member.

[hamada-09:2013] Mohamed Hamada, April 2013.

Senior Member.

[vkluev-09:2013] V Klyuev, Apr. 2013.

Member

[vkluev-10:2013] V Klyuev, April 2013.

Member

Ph.D and Others Theses

[hamada-10:2013] Takahiro Mitsui. A Smart Multimedia Learning System for Japanese Language, University of Aizu, 2013.

Thesis Advisor: M. Hamada

[hamada-11:2013] Toshiaki Suzuki. Developing a Recipe Multimedia Book for Smart Devices, University of Aizu, 2013.

Thesis Advisor: M. Hamada

[hamada-12:2013] Takashi Satomi. Study and Analysis of Smart Devices Apps Promotion, University of Aizu, 2013.

Thesis Advisor: M. Hamada

[hamada-13:2013] Keisuke Konno. Developing a Multipurpose Preschool Learning System, University of Aizu, 2013.

Thesis Advisor: M. Hamada

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- [hamada-14:2013] Yuki Kashimura. Programming Languages Learning Tool Based on iPhone, University of Aizu, 2013.
Thesis Advisor: M. Hamada
- [hamada-15:2013] Takahito Nakashima. Developing an iOS-based Math Learning System for School Students, University of Aizu, 2013.
Thesis Advisor: M. Hamada
- [vkluev-11:2013] Masaya Hoshi. Quiz Generator: Web Application using Cloud Computing, University of Aizu, March 2014.
Advisor: Klyuev, V
- [vkluev-12:2013] Naohiro Togashi. Performance Comparison of Concurrency in Go and Java, University of Aizu, March 2014.
Advisor: Klyuev, V
- [vkluev-13:2013] Motoki Miyashita. Accuracy of Compound Noun Detection using TermExtract, University of Aizu, March 2014.
Advisor: Klyuev, V