（**Abroad**・Domestic）Internship report form（Student） 2016/04/12 (Year/Month/Day)

Name	Tessmer, Heidi Lynn
Laboratory	Division of Bioinformatics
Year (Grade)	3
Internship institution	Seoul National University
Internship period	Internship period: 12/28/2015 - 03/24/2016 (Departure Date from Sapporo: 12/27/2015, Arrival Date in Sapporo: 03/25/2016)
Purpose	Internship and Collaborative Research

- The reason why you chose this institute

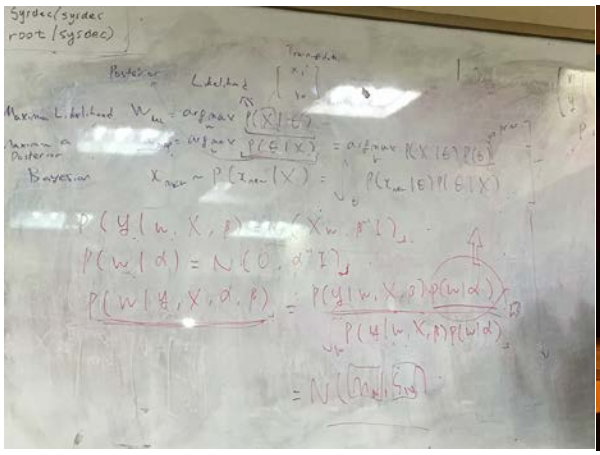
I chose Seoul National University's Biointelligence Laboratory in the School of Computer Science and Engineering for many reasons. During my research at Hokkaido University, I had been reading course notes and papers from Professor Zhang's group for several months. His group's work on machine learning was very interesting to me, and further, their work on applying bioinformatics algorithms and knowledge to alternative problems was fascinating. I wished to know more about the team's work and also to learn a number of the techniques they were using in machine learning, so that I may apply them to my own research. Further, I looked for an internship with an academic institution as I am interested in the possible careers available for programmers in academia, aside from principal investigators, postdocs, and professors. The internship program at SNU would hopefully give me insight into all of these potential career paths.

- Result of the activity （about 800 words、provide photos, tables and figures that clearly show the activities during the period）

I learned many things during my internship and collaborative research at Seoul National University's Biointelligence Laboratory. Here, I will describe activities relevant to both aspects of my trip.

From the standpoint of an internship, I experienced life in a large (approximately 30 people), international laboratory consisting of both Masters and Doctoral track

students. The laboratory focuses on computer science and artificial intelligence from the software side. As an intern, I was responsible for implementing a PhD student's research idea as a member of a small research team. My responsibilities also included sharing software programming best practices, system administration techniques, and peer reviews of documents prior to publication. I also attended course lectures, seminars, and symposia both within the university and the greater community. These activities gave me a better understanding of how a large laboratory works; the activities of professors, post docs, and software developers. I also had the opportunity to speak to the laboratory professor, Professor Zhang, regarding future goals for the laboratory, as well as expectations of a laboratory with respect to government funding and output beneficial to society.



(The images above show: on the left – notes from a course on maximum likelihood approximation and Bayesian formulas, on the right – an international symposium on artificial intelligence, with representatives from IBM, Microsoft, and MIT presenting their work and the future of AI within their companies and also representatives from Japan and Korea expressing their plans for AI and machine learning research over the next five to 10 years.)

My first project was working with the DNA computing group. I read the current research and techniques, and then assisted in analyzing and discussing alternative ways to uniquely encode images onto DNA. Using existing DNA generation software, I focused on the feasibility and uniqueness of the strands produced by the software and also considered the biological implications of combinations. My discussions with the team lead assisted in producing the first

implementation idea, which was later replaced with a more efficient version along similar lines.

Following the theoretical work with the DNA computing team, I moved onto machine learning application development with a student investigating music regeneration using various learning models. In this project, I implemented several machine learning and neural network models, including the feed-forward multilayer perceptron (MLP) and convolutional neural network (CNN) models, and continuous-time neural networks, including long short-term networks (LSTM) and gated recurrent unit (GRU) networks which are members of the group of recurrent neural networks (RNN). I also investigated memory networks, which may be useful in future work.

(The picture above shows our first software project design for the musiome project. The musiome project involved all aspects of the software development process, from design through to implementation and documentation. The photo on the right shows the line for the bus to Seoul National University in the mornings. My bus stop is the one far in the distance and I am at the end of the line for the bus.)

As a member of the musiome project team, I also gained experience in writing papers, especially in the field of computer science. I drafted the first version of the paper for the project in January and continued to modify and update the

paper as our research progressed.

The models and machine learning techniques I learned at SNU can be combined to form more complex models and depending on the quantity and complexity of data used, can discover complex patterns within the data that would take humans many years to find. The next step in this research is to formulate the questions and apply these models to the different genomic data we have.

Altogether, I feel this internship was a complete success, though two more months would have been better to allow for the completion of the project. As it is, I have had to leave in the middle of the implementation and writing of the paper with respect to the research we conducted. However, I gained extremely valuable experience with software development and design in a research environment, writing, reading, and reviewing computational and technical papers, and overall experience with the process of computer science research and the steps involved in designing quality projects and experiments. While at SNU, I also took an online course in R programming, improved my Python programming skills, and learned the languages, APIs, and calls for lasagne, librosa, scipy, numpy, and numerous other packages and libraries useful in writing machine learning programs. Additionally, I learned of other technologies, such as Keras and Lua, which I may learn and make use of in the future. All of these tools are important and necessary to the successful implementation of machine learning research and will be crucial in my future research at Hokkaido University.

- What do you think the positive impact of the activity will have on your further research, student life and career path?

As hoped, I gained a clearer picture of the numerous opportunities in academia as well as in industry during my internship at SNU. In addition to a better understanding of available career paths, I also met many people who may have or know of employment opportunities in the future. The positive impact of this activity is therefore both a clear path to employment and possible leads in achieving my career goals.

- Advice for your junior fellows

Do not be afraid to fail. Go out and try something new. You never know what you will find and you will not know what you can do, unless you try. Even if you do fail, you will learn something on the way. If you succeed, you will have succeeded in something great. Good luck!

Approval of supervisor	Institution・Official title・Name Research Center for Zoonosis Control Professor 印 Ito, Kimihito

※1 Send the electronic file to the Leading School section, International Affairs Office, also submit the original print out with seal of supervisor to the Leading School section, International Affairs Office.
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※3 The Steering Committee of the Leading Program will first confirm the content of this report and report will be forwarded to the Educational Affairs Committee for credits evaluation.

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