

Professional Development Assignment Report
Lih-Yuan Deng
Department of Mathematical Sciences

Quick summary of my Professional Development Assignment proposal

My proposed PDA plan was to visit Institute of Statistics, National Chiao Tung University during the period of January 1, 2016 to June 30, 2016. I believe that it will continue to enhance this new and exciting research on the secure random number generator which has a great chance for a funded research. Professor Lu and Professor Shiau, both from NCTU, will be writing a research proposal to Ministry of Science and Technology of Taiwan (MOST) to sponsor my visit. NCTU is among the best (top 3) universities in Taiwan. Only the best students can get admission through the nation-wide unified entrance examination. Therefore, I plan to use my visit to make personal contacts and recruit their best students to enroll our university for their advanced graduate study. This plan will benefit myself for performing joint research with researchers and the university will also benefit for the possibility of recruiting their top students for advanced graduate study in the University of Memphis.

Summary of research achievements during my Professional Development Assignment

I have a long term, close and successful collaboration with Professor H. H. S. Lu and Professor J. J. H. Shiau, both from Institute of Statistics, National Chiao Tung University. Professor Lu sponsored my visit at NCTU through one of his grants from Ministry of Science and Technology of Taiwan (MOST). Professor Lu is currently serving as the Provost at NCTU and he is also the Director of Big Data Center at NCTU. There are several research achievements for my visit at NCTU:

1. continuation of joint research work on the field of designing random number generators for both computer simulation and computer security applications,
2. development of a new methodology for alignment-free method on DNA sequence analysis,
3. application of data privacy-preserving procedure to some popular statistical procedures like I-score, and
4. extension/generalization of I-score to improve the prediction/classification performance on the big-data.

In addition, I have participated regularly in the weekly Statistics seminars jointly hosted by Institute of Statistics of National Chiao Tung University and Institute of Statistics of Tsing Hua University. Finally, I also engaged in several scholarly activities such as

1. chairing a session in STSC25 (The 25th South Taiwan Statistics Conference) on June 24-25, 2016
2. attending the big-data workshop organized by Professor Lu at NCTU on June 28, 2016,
3. regular research meetings organized by Professor H. H. S. Lu and visiting scholar Professor Salil P. Vadhan (Harvard University) on the emerging topic of data privacy-preserving.

Manuscripts written

1. Paper accepted for publication:

- Si Chen, Lih-Yuan Deng, Dale Bowman, Jyh-Jen Horng Shiau, Tit-Yee Wong, Behrouz Madahian and Henry Horng-Shing Lu, "Phylogenetic Tree Construction Using Trinucleotide Usage Profile (TUP)", accepted by *BMC Bioinformatics* (a highly ranked leading journal) for publication.

2. Paper revision for publication:

- Lih-Yuan Deng, Jyh-Jen Horng Shiau, Henry Horng-Shing Lu, and Dale Bowman, "Secure And Fast Encryption (SAFE) with Classical Random Number Generators", second revision requested by *ACM Transaction on Mathematical Software (ACM TOMS)*.

3. Papers submitted for publication:

- Lih-Yuan Deng, Bryan Winter, Jyh-Jen Horng Shiau and Henry Horng-Shing Lu, "Design and Efficient Implementation of a Large Class of High-Quality Pseudo Random Number Generators", submitted to *ACM Transaction on Mathematical Software (ACM TOMS)*.
- Lih-Yuan Deng, Bryan Winter, Jyh-Jen Horng Shiau and Henry Horng-Shing Lu, "Computation of spectral tests for multiple recursive generators", submitted to *Mathematics and Computers in Simulation (IMACS)*.

Other collaborative activities

I believe that I have greatly improved the research and academic environment in Institute of Statistics, National Chiao Tung University with the following activities: (1) shared my expertise on the design of better random number generators for applications in the computer simulation and computer security (2) actively contributed the collaborative research work on the topic of data-privacy preserving (3) initiated several new research works like innovative DNA sequence analysis and extension of popular I-score for better prediction.

With my research collaboration, integration of various research topics such as design of better random number generators for computer security and simulation/Monte Carlo study, big-data analysis, DNA sequence analysis, and data-preserving could have important impact and useful application on the several of Professor Lu's research projects.

It is great to meet and collaborate a leading expert like Professor Salil P. Vadhan from Harvard University during his sabbatical visit NCTU. Salil is a leading expert in this new and emerging area of gene data privacy. We had a weekly meeting to discuss some potential topics of some joint papers to be developed in the future.