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## **Why is Interdisciplinary Research Hard**

by

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For those who have read “My Story” or browsed through my website, you know that I was a Program Director at NSF between 2001 and 2004. That was when I was introduced to interdisciplinary research. Before that, while I was at MITRE, all of my research was in computer science including in information security and data management. However, when I went to NSF, I soon realized that interdisciplinary research was strongly encouraged. Furthermore, I was the representative from my division on programs in bioinformatics and geo-informatics. This was because Dr. Maria Zemankova invited me to join NSF as IPA and take over her programs while she was on sabbatical at NLM conducting interdisciplinary research herself. I learnt at that time that biologists, computer scientists and geologists had to work together to advance bioinformatics and geo-informatics. I learnt a lot about bioinformatics from Dr. Sylvia Spengler who was at NSF and also by managing proposals in bioinformatics. I benefited from discussions with Dr. Steve Meacham at NSF on geo-informatics.

Around 2002, I had many discussions with the acting director of my division Dr. William (Bill) Bainbridge who was a social scientist. Until then I had very little appreciation for the work carried out by social scientists. At that time I thought that social scientists were doing esoteric research and this research was not concrete. However, discussions with Bill made me realize that social scientists did tangible research and made enormous contributions to society. Furthermore, about this time I got interested in social networks for my research on applying data mining for counter-terrorism. Therefore, I encouraged proposals on the integration of social networks and data mining for my programs.

When I joined the University of Texas at Dallas, I started interacting with those from our school of management and the school of economics and policy sciences. These interactions have given us enormous success in getting awards from organizations such as NSF, AFOSR, IARPA, ONR, NASA, NGA and NIH. While there are numerous benefits from conducting interdisciplinary research, in my opinion such research can be very challenging. Here are the main reasons.

- (i) Computer scientists and non computer scientists speak different languages. For example, social scientists and biologists think that computer scientists build tools to support them. However, we computer scientists have to overcome several obstacles in building successful tools. We have to analyze semantics, improve performance, and make sure that the tools are usable. This is not a

- simple activity. Therefore we feel in general that social scientists, physical scientists and bioscientists do not appreciate us enough.
- (ii) Social scientists and bio-scientists often complain that computer scientists work on toy applications. They state that computer scientists start building the tools immediately without much consideration for the users. This criticism is a valid criticism. Because a computer scientist is interested in the design and development of the system, we plunge into the development without understanding the needs of the application specialists.
  - (iii) It is very hard to publish the research results. Because our research is not pure social science or pure computer science, it is very difficult to get the papers accepted in premier conferences or journals. We often get comments that the paper is not within the scope of the conference or the journal. There are a few journals like the IEEE Transactions in Systems, Man and Cybernetics that publish the interdisciplinary papers. We need more venues for publishing such papers.
  - (iv) Having real world data to test the results is a challenge. This is something both the computer scientists and the non computer scientists feel is a major obstacle to conducting interdisciplinary research. Computer scientists want some data to test the tools and so any data that they can get hold of, even simulation data, is sufficient for them. However, social scientists or bio-scientists will only accept the results that have been tested with real world data. It is almost impossible to get meaningful data. Due to privacy concerns it is difficult to get data about people. Corporations do not release data as their data is gold for them. Furthermore, agencies sanitize the data before releasing them. While sanitized data is agreeable to most computer scientists, this is absolutely not the case say with social scientists and bio-scientists. Computer scientists conduct experiments by randomizing and perturbing values. This is totally unacceptable to the non computer scientists.

So what should we do about interdisciplinary research? Should we abandon it? Absolutely not. For us computer scientists, interdisciplinary research is the future. Here are some suggestions that we might want to follow.

- (i) First, be patient and try and understand the non computer scientists. Understand their needs and challenges. Do not try and push your technology into them. One size does not fit all. Therefore, technology developed for say a financial application may have to be tailored for bio science applications. We may even have to develop a new technology for the bio science applications. For example, financial data are very structured while say geospatial data are unstructured. Therefore, we may need different tools for geospatial data.

- (ii) Organize joint conferences with the non computer scientists and this will result in new opportunities to establish interdisciplinary journals. There are very few of them now. But as we make progress in interdisciplinary fields, there will be opportunities to establish new journals.
- (iii) With respect to data, this is still a big challenge. However, here we need to work jointly with the non computer scientists and obtain data. We need to find out from data providers what their concerns are and work together to alleviate their concerns.
- (iv) Finally, we may want to take certificates and courses in the non computer science area. Here is my example. About 50% of my research is to apply data mining for counter-terrorism applications. However, I know very little about terrorism. Therefore, I am planning to take the online certificate course on terrorism studies offered by St. Andrews University in Scotland. This will, I hope, give me a much better understanding of how terrorists operate. As a result, I could develop special purpose tools to catch the terrorists.

What prompted me to write this article at this time is a workshop I attended at Microsoft Research in Seattle earlier this month. This workshop was sponsored by NSF. At this workshop, we discussed how we can obtain data to conduct research between social scientists and computer scientists. As part of the breakout sessions, we discussed the opportunities and barriers to conduct interdisciplinary research. I discussed many of my ideas that I had developed since 2001 on interdisciplinary research. I thought I would summarize these ideas so that those who conduct interdisciplinary research could benefit from this article.

I hope this article was useful to you. I would welcome comments and suggestions. Please visit my web site at <http://www.utdallas.edu/~bxt043000> for details on my work. For questions, please email me at [dr.bhavani@yahoo.com](mailto:dr.bhavani@yahoo.com)

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