IU BLOOMINGTON

EMERGING AREAS OF RESEARCH

Abstract Template -- Due June 30, 2017

Title of initiative to be proposed:

Probabilistic Approaches to Computational Problems

Name of lead PI, with title, department/school:

Funda Ergun, Professor, Department of Computer Science/School of Informatics and Computing (fergun@indiana.edu)

Key team member names and departments/schools (up to 10 names):

Michael Trosset - Department of Statistics, College or Arts and Sciences; Qin Zhang - Department of Computer Science, School of Informatics and Computing; Yuan Zhou - Department of Computer Science, School of Informatics and Computing; Russell Lyons - Department of Mathematics, College of Arts and Sciences; David Fisher - Department of Mathematics, College of Arts and Sciences; Michael Larsen - Department of Mathematics, College of Arts and Sciences; Ciprian Demeter - Department of Mathematics, College of Arts and Sciences

Description of area to be proposed. What constitutes this area of research or creative activity as emerging? (Word limit=500)

With the ever-increasing ability to collect and store massive amounts of complex data comes the need for efficient algorithms to process and analyze that data. The data can be whole genomes of many species, streaming sound or video or text data, multidimensional data with missing values, etc. The desired object may be a network rather than a simple numerical summary. Using probability cleverly often improves the computation in addition to measuring the chances an approximate algorithm gives the correct answer. This proposal builds a connection between existing areas of expertise on campus in order to improve probabilistic approaches to computational problems. The collaboration will lead to increased opportunities for external funding and for patentable algorithms and will position Indiana University to become a world leader in this interdisciplinary area. The research questions to be investigated initially include the development of probabilistic methods for communication-efficient algorithms for distributed optimization across a network of computers, for metric embeddings and manifold learning (reducing a problem in a complicated space to a problem in a simpler space in order to facilitate its solution or visualization), and for generating random graphs that more accurately model real-world networks for use in computational algorithms.

Please submit to earprogram@indiana.edu