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14. ABSTRACT					
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a. REPORT UU	b. ABSTRACT UU	c. THIS PAGE UU			19b. TELEPHONE NUMBER 702-895-3681

RPPR Final Report
as of 25-Jun-2018

Agency Code:

Proposal Number: 68817NSREP

Agreement Number: W911NF-16-1-0416

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Report Date: 01-Apr-2018

Date Received: 08-Jun-2018

Final Report for Period Beginning 01-Aug-2016 and Ending 01-Jan-2018

Title: Acquisition of High Performance Computing Instrument for Network Science Research and Education

Begin Performance Period: 01-Aug-2016

End Performance Period: 01-Jan-2018

Report Term: 0-Other

Submitted By: Justin Zhan

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Distribution Statement: 1-Approved for public release; distribution is unlimited.

STEM Degrees: 3

STEM Participants: 10

Major Goals: The objective of this proposal is to acquire an integrated high performance computing instrument for big data in network science research and education at University of Nevada Las Vegas.

Accomplishments: Integrated high performance computing instrument for big data in network science research and education has been acquired.

We have used the instrument for various big data research projects including data bridge system project, community detection for large networks project, a deep learning framework for network dynamics prediction project, and more than 50 class projects.

We have also used the instrument for education and course delivery including big data analytics course, deep learning for big data course, and applied big data course.

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Training Opportunities: This instrument has strengthened educational training activities by enabling innovative big data courses and promoting our education outreach activity with K-12 teachers and students. A key use of the HPC was to provide training in advanced computing environments and support for faculty and students at University of Nevada Las Vegas (UNLV).

PI is leading a summer program for high/middle school students and teachers. We have 40 students and teachers each summer to attend our 6-week summer program on big data. We provide seminars and demonstrations about bridging network big data from various disciplinary perspectives during this camp to attract students to the field of computing sciences. The demonstrations not only excites high school students but also educates them about network big data problems facing the digital age.

Results Dissemination: We gave presentations at various conferences such as International Conference on Big Data. Our presentations aimed at scholars whose research and education interests are on big data analytics. We also published our research results in peer-reviewed journals.

Honors and Awards: Congressional Recognition Award, US Congresswoman Jack Rosen, Member of Congress, Third District, Nevada, July 2017.

The United States Army Mentorship Award for Research & Engineering Apprenticeship Program, July 2017.

Distinguished Researcher Award, College of Engineering, University of Nevada Las Vegas, April 2017.

Outstanding Researcher Award, Department of Computer Science, University of Nevada Las Vegas, April 2017.

Faculty Mentor Award, Center for Academic Enrichment and Outreach, University of Nevada Las Vegas, November 2016.

Faculty Fellow, Air Force Research Laboratory, May-August 2016.

Protocol Activity Status:

Technology Transfer: Nothing to Report

PARTICIPANTS:

Participant Type: PD/PI

Participant: Justin Zhan

Person Months Worked: 2.00

Project Contribution:

International Collaboration:

International Travel:

National Academy Member: N

Other Collaborators:

Funding Support:

Participant Type: Co-Investigator

Participant: Kazem Tagva

Person Months Worked: 1.00

Project Contribution:

International Collaboration:

International Travel:

National Academy Member: N

Other Collaborators:

Funding Support:

Participant Type: Co-Investigator

Participant: Ge Lin Kan

Person Months Worked: 1.00

Funding Support:

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Project Contribution:
International Collaboration:
International Travel:
National Academy Member: N
Other Collaborators:

Participant Type: Co-Investigator

Participant: Bing Zhang

Person Months Worked: 1.00

Funding Support:

Project Contribution:
International Collaboration:
International Travel:
National Academy Member: N
Other Collaborators:

Participant Type: Co-Investigator

Participant: Haroon Stephen

Person Months Worked: 1.00

Funding Support:

Project Contribution:
International Collaboration:
International Travel:
National Academy Member: N
Other Collaborators:

ARTICLES:

Publication Type: Journal Article

Peer Reviewed: Y

Publication Status: 1-Published

Journal: IEEE Access

Publication Identifier Type: DOI

Publication Identifier: 10.1109/ACCESS.2018.2797048

Volume: 6

Issue:

First Page #: 7872

Date Submitted: 6/8/18 12:00AM

Date Published:

Publication Location:

Article Title: Finding Top- k Dominance on Incomplete Big Data Using MapReduce Framework

Authors: Payam Ezatpoor, Justin Zhan, Jimmy Ming-Tai Wu, Carter Chiu

Keywords: Top-k dominance, incomplete data, bigdata, mapreduce, hadoop, dominance relationship, query processing.

Abstract: Incomplete data is one major kind of multi-dimensional dataset that has random-distributed missing nodes in its dimensions. It is very difficult to retrieve information from this type of dataset when it becomes large. Finding top-k dominant values in this type of dataset is a challenging procedure. Some algorithms are present to enhance this process, but most are efficient only when dealing with small incomplete data. This paper proposes MapReduced Enhanced Bitmap Index Guided Algorithm (MRBIG) for dealing with the aforementioned issues. MRBIG uses the MapReduce framework to enhance the performance of applying top-k dominance queries on large incomplete datasets. The proposed approach uses the MapReduce parallel computing approach involving multiple computing nodes. The framework separates the tasks between several computing nodes to independently and simultaneously work to find the result.

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Acknowledged Federal Support: Y

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Publication Type: Journal Article Peer Reviewed: Y **Publication Status:** 1-Published
Journal: IEEE Transactions on Big Data
Publication Identifier Type: DOI Publication Identifier: 10.1109/TBDATA.2016.2628725
Volume: 3 Issue: 3 First Page #: 276
Date Submitted: 6/8/18 12:00AM Date Published: 9/1/17 7:00AM
Publication Location:
Article Title: A Framework for Community Detection in Large Networks Using Game-Theoretic Modeling
Authors: Pravin Chopade, Justin Zhan
Keywords: Game theory, large-scale networks, community detection, adjacency, Laplacian, modularity, similarity, clustering
Abstract: This paper presents a new game-theoretic approach towards community detection in large-scale complex networks based on modified modularity; this method was developed based on modified adjacency, modified Laplacian matrices and neighborhood similarity.
Distribution Statement: 1-Approved for public release; distribution is unlimited.
Acknowledged Federal Support: Y

Publication Type: Journal Article Peer Reviewed: Y **Publication Status:** 1-Published
Journal: IEEE Access
Publication Identifier Type: DOI Publication Identifier: 10.1109/ACCESS.2017.2771448
Volume: 5 Issue: First Page #: 27354
Date Submitted: 6/8/18 12:00AM Date Published:
Publication Location:
Article Title: A Novel Weak Estimator For Dynamic Systems
Authors: Moinak Bhaduri, Justin Zhan, Carter Chiu
Keywords: Stochastic learning weak estimators, dynamic systems, continuous time Markov chain, countable state space, non-stationarity, classification, simulation
Abstract: In this paper, we propose a novel approach for classifying incoming continuous data under a non-stationary environment. A class of estimators termed stochastic learning weak estimators has been generalized to include continuous time sampling and countable state categories. The method is founded on non-stationary Markov chain techniques and is useful in diverse applications, such as consumer behavior analysis, e-mail spam classification, or understanding drug effectiveness. In terms of tracking the true state probabilities, these weak estimators consistently outperform traditional competitors such as maximum likelihood estimates. Only one user defined parameter is necessary and the method is free of subjective “moving window” type algorithms. We have conducted extensive simulations and real data analyses for classification purposes.
Distribution Statement: 1-Approved for public release; distribution is unlimited.
Acknowledged Federal Support: Y

Publication Type: Journal Article Peer Reviewed: Y **Publication Status:** 1-Published
Journal: IEEE Access
Publication Identifier Type: DOI Publication Identifier: 10.1109/ACCESS.2017.2773038
Volume: 5 Issue: First Page #: 26364
Date Submitted: 6/8/18 12:00AM Date Published:
Publication Location:
Article Title: Toward Efficient Hub-Less Real Time Personalized PageRank
Authors: Matin Pirouz, Justin Zhan
Keywords: Graph theory, hub nodes, PageRank, personalized PageRank
Abstract: In the era of big data, reduced models capable of reducing big data graph to estimate personalized PageRank are limited. Personalized PageRank is a page rank calculation where random jumps are only allowed to a subset of start nodes. The resources of current process of calculation of personalized PageRank are highly prohibitive, thus in this paper we propose a novel fast accurate and less resource intensive algorithm to the personalized PageRank problem. FAST Personalized PageRank is utilized to find the target node set. Using the mentioned target set, the algorithm gives an estimation of the closeness of any pair of nodes in the graph. As the time taken by the estimation of personalized PageRank is directly proportional to the network size, in this paper a node reduction method is used to prune the graph.
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Journal: IEEE Access

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Publication Identifier: 10.1109/ACCESS.2017.2735378

Volume: 5

Issue:

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Date Published:

Publication Location:

Article Title: A Novel Online and Non-Parametric Approach for Drift Detection in Big Data

Authors: Moinak Bhaduri, Justin Zhan, Carter Chiu, Felix Zhan

Keywords: Change point detection, non-parametric methods, Hoeffding's inequality, Bernstein's inequality, big data, anomaly detection

Abstract: A sizable amount of current literature on online drift detection tools thrive on unrealistic parametric strictures such as normality or on non-parametric methods whose power performance is questionable. Using minimal realistic assumptions such as unimodality, we have strived to proffer an alternative, through a novel application of Bernstein's inequality. Simulations from such parametric densities as Beta and Logitnormal as well as real-data analyses demonstrate this new method's superiority over similar techniques relying on bounds, such as Hoeffding's. Improvements are apparent in terms of higher power, efficient sample sizes, and sensitivity to parameter values.

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Publication Type: Journal Article

Peer Reviewed: Y

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Publication Identifier: 10.1109/ACCESS.2017.2726078

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Article Title: Uncovering Suspicious Activity From Partially Paired and Incomplete Multimodal Data

Authors: Carter Chiu, Justin Zhan, Felix Zhan

Keywords: Suspicious activity, multimodal data, partially paired data, incomplete data

Abstract: Multimodal data can be used to gain additional perspective on a phenomenon. For applications, such as security and the detection of suspicious activity, the need to aggregate and analyze data from multiple modes is vital. Recent research in suspicious behavior detection has introduced methods for identifying and scoring dense blocks in multivariate tensors, which are consistent indicators of suspicious activity. None yet, however, have proposed a method for the merging and analysis of multiple modes of data for suspicious behavior, especially when the set of items described in each data set do not match—that is, the data is partially paired—which is common when data sets originate from different sources. Neither has a method been described for dealing with the similar case of incomplete data. This paper introduces a technique for multimodal data analysis for suspicious activity detection when the data are only partially paired and/or incomplete. The method is applied to synthetic and r

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Publication Identifier Type: DOI Publication Identifier: 10.1109/ACCESS.2017.2723838
Volume: 5 Issue: First Page #: 13046
Date Submitted: 6/8/18 12:00AM Date Published:
Publication Location:

Article Title: Using Proxies for Node Immunization Identification on Large Graphs

Authors: Raymond Ahn, Justin Zhan

Keywords: Immunization, linear time, proxies, tree-graph

Abstract: Given a large graph, like a social network, which k nodes should be immunized (or removed) to make the network safe from the spread of a virus? This is the node immunization problem. One of the classical methods, inspired by immunology, in analyzing this problem relies on the calculation of the largest eigenvalue before and after immunization in order to create the largest difference in eigenvalue. We propose a method that does not rely on a costly calculation of eigenvalues; instead, we rely on the notion of proxies and deterministic routing areas in order to find such nodes to immunize. We show that our results are consistent with the notion of vulnerability and produces equivalent results when compared with the existing algorithms. Furthermore, experimental results show that when a virus is not allowed to die out (controlled by the strength of the virus), our algorithm ensures that more nodes are safe from infection.

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Publication Identifier Type: DOI Publication Identifier: 10.1109/ACCESS.2017.2702281
Volume: 5 Issue: First Page #: 10024
Date Submitted: 6/8/18 12:00AM Date Published:
Publication Location:

Article Title: Ant Colony System Sanitization Approach to Hiding Sensitive Itemsets

Authors: Jimmy Ming-Tai Wu, Justin Zhan, Jerry Chun-Wei Lin

Keywords: Privacy-preserving data mining, evolutionary algorithm, sensitive itemsets, ant colony system

Abstract: In this paper, an ant colony system (ACS)-based algorithm called ACS2DT is proposed to decrease side effects and enhance the performance of the sanitization process. Each ant in the population will build a tour for each iteration and each tour indicates the deleted transactions in the original database. The proposed algorithm introduces a useful heuristic function to conduct each ant to select a suitable edge (transaction) for the current situation and also designs several termination conditions to stop the sanitization processes. The proposed heuristic function applies the pre-large concept to monitor side effects and calculates the degree of hiding information to adjust the selecting policy for deleted transactions. The experimental results show that the proposed ACS2DT algorithm performs better than the Greedy algorithm and other two evolutionary algorithms in terms of runtime, fail to be hidden, not to be hidden, not to be generated and database similarity on both real-world and sy

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Journal: Journal of Big Data

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Publication Identifier: 10.1186/s40537-017-0095-2

Volume: 4

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Date Published: 10/1/17 12:00AM

Publication Location:

Article Title: Using deep learning for short text understanding

Authors: Justin Zhan, Binay Dahal

Keywords: Short text classification, Semantic enrichment, Deep neural network

Abstract: Classifying short texts to one category or clustering semantically related texts is challenging, and the importance of both is growing due to the rise of microblogging platforms, digital news feeds, and the like. We propose to address this issue using semantic enrichment. This is accomplished by taking the nouns, and verbs used in the short texts and generating the concepts and co-occurring words with the help of those terms. The nouns are used to generate concepts within the given short text, whereas the verbs are used to prune the ambiguous context (if any) present in the text. The enriched text then goes through a deep neural network to produce a prediction label for that short text representing its category.

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Journal: Journal of Big Data

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Publication Location:

Article Title: Identification of top-K nodes in large networks using Katz centrality

Authors: Justin Zhan, Sweta Gurung, Sai Phani Krishna Parsa

Keywords: Top-K nodes, Katz centrality, Social networks

Abstract: In this paper, we propose a novel method for identifying top-K viral information propagators from a reduced search space. Our algorithm computes the Katz centrality and Local average centrality values of each node and tests the values against two threshold (constraints) values. Only those nodes, which satisfy these constraints, form the search space for top-K propagators.

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Publication Location:

Article Title: Vaccination allocation in large dynamic networks

Authors: Justin Zhan, Timothy Rafalski, Gennady Stashkevich, Edward Verenich

Keywords: Dynamic networks, Immunization, Dominance tree

Abstract: Network infections that are already in progress cause challenges to those officers trying to preserve those nodes not yet infected. Static solutions can take advantage of global knowledge of the network to produce quick and approximate answers for those members who should be vaccinated. In dynamic situations however, small changes can severely alter those static solutions making them irrelevant. Yet in dynamic situations it can not be known with certainty which small changes will affect the solution and those that will not. Computational resources are wasted recalculating a global solution for the entire network, when a local recalculation may be enough. This paper presents a dynamic node vaccination solution that seeks to take advantage of these local recalculations

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DISSERTATIONS:

Publication Type: Thesis or Dissertation

Institution: University of Nevada Las Vegas

Date Received: 08-Jun-2018

Completion Date: 5/31/17 8:08PM

Title: FINDING TOP-K DOMINANCE ON INCOMPLETE BIG DATA USING MAP-REDUCE FRAMEWORK

Authors: Payam Ezatpoor

Acknowledged Federal Support: **N**

Publication Type: Thesis or Dissertation

Institution: University of Nevada Las Vegas

Date Received: 08-Jun-2018

Completion Date: 5/1/18 7:00AM

Title: ADVANCING COMMUNITY DETECTION USING KEYWORD ATTRIBUTE SEARCH

Authors: Sanket Chobe

Acknowledged Federal Support: **N**

Publication Type: Thesis or Dissertation

Institution: University of Nevada Las Vegas

Date Received: 08-Jun-2018

Completion Date: 5/31/17 7:00AM

Title: HIGH UTILITY ITEMSETS IDENTIFICATION IN BIG DATA

Authors: Ashish Tamrakar

Acknowledged Federal Support: **N**

Nothing to report in the uploaded pdf