ALI TIZGHADAM

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PARTICULARS

EDUCATION

University of Toronto — Toronto,ON, Canada
PhD in Electrical & Computer Engineering (Communications) — *June 2009*

University of Tehran — Tehran, Iran
M.A.Sc. in Electrical & Computer Engineering (Communications) — *September 1994*

University of Tehran — Tehran, Iran
B.Sc in Electrical & Computer Engineering (Control) — *September 1991*

CURRENT STATUS

Citizen of Canada.

RESEARCH INTERESTS

My research interests span the areas of intelligent transportation systems (ITS), cloud computing, network science, network control, electrical grids and smart grid communications, (wireless) communication networks, virtualization, green communications, network planning, control theory, optimization theory and its applications.

DISSERTATION

Title: "Autonomic Core Network Management System"
Advisor: Prof. Alberto Leon-Garcia
In my thesis, I used the idea of Virtual Networks and Autonomic Computing and proposed AutoNet, a conceptual architecture for self-organizing network management systems, to control the allocation of resources in communication networks. I employed graph-theoretic tools and developed an analytical framework for the design of robust networks and robust control algorithms. I applied the theoretical framework to the case of core networks, where robustness to the environmental changes is proved important, and proposed appropriate control algorithms for AutoNet. Furthermore, I have recently applied the framework to design robust and sparse power grids.

ACADEMIC HONORS

- Paper selected among high quality papers presented in plenary session of 7^{th} Workshop on Design of Reliable Communication Networks (DRCN), October 2009, Washington DC, USA.
- Paper won student travel award in 21^{th} International Teletraffic Congress (ITC21), September 2009, Paris, France.
- Paper won student travel award in INFOCOM Workshop on Network Science for Communications (NetSciCom), April 2009, Rio de Janeiro, Brazil.
- University of Toronto and NSERC Post Doctoral Fellowship, 2009-2010.
- University of Toronto Fellowship, 2007-2008.
- Ontario Graduate Scholarship in Science and Technology, 2006-2007.
- Rogers Fellowship, 2005-2006.
- University of Toronto Fellowship, 2003-2005.
- Innovation prize (Kharazmi) for the design of medium scale digital exchange.

RESEARCH EXPERIENCE

- **Senior Research Associate, University of Toronto, Canada**, Dec. 2011 - Present.
  - **Connected Vehicles and Smart Transportation (CVST)**: I work in CVST as project coordinator. CVST is a university-undustry-government collaboration with the goal of creating a mobile computing cloud to support connected vehicles and smart transportation infrastructure. The mobile cloud with support a range of software applications and provide vehicles with permanent connectivity to each other. The project includes three major research objective: 1) to create an application platform for connected vehicles and smart transportation systems, 2) to create large-scale smart management applications on CVST platform that will improve safety and efficiency of publicly-operated intelligent transportation systems, 3) to develop novel applications that leverage CVST platform and that can be offered by the private sector for connected vehicle environment.
  - **Green-Touch Project**: Green-Touch is an international project on green communications led by Alcatel-Lucent Bell Labs. The goal of the project is to redesign communication devices and algorithms so that the energy consumption is significantly reduced. University of Toronto collaborates with Green-Touch on a number of directions. I am supervising a research on developing robust and green flow assignment algorithms for communication networks.
  - **Supervising PostDocs and Graduate Students:** As the project coordinator in CVST project, I work with four post doctoral fellows to orchestrate their research activities and to make sure that the whole project is moving smoothly according to the specified milestones. I also supervise a group of graduate students in their research activities within the scope of CVST and Green-Touch projects.
  - **Book Preparation:** I work on preparing a monograph based on my previous and current research work. The main focus of the monograph is in the application of network science in communication networks, transportation systems, and power grids.
- **Post Doctoral Research Fellow, University of Toronto, Canada** (Joint with Lakehead University), July 2010 - May 2011.
  - **Integrated Wireless-Optical Access Network (IWOAN)**: The purpose of this project was to design a dense-cell high-bandwidth latency-sensitive integrated wireless-optical broadband access network. The project aimed to design the architecture as well as appropriate resource management algorithms for IWOAN. As a part of resource allocation algorithm design, we considered the case of smart meters and design a secure overlay in the wireless section of the IWOAN to provide reliable wireless connectivity for smart meters.
  - **Supervising Graduate Students:** As a part of my job, I helped graduate students in their research work as a co-supervisor.
- **Post Doctoral Research Fellow, University of Toronto, Canada**, June 2009 - May 2010.
  - **Robust Spectrum Management in Cognitive Radio Networks (CRN)**: We employed network science concepts (in particular network criticality) to design robust algorithms for power and spectrum management in CRN.
  - **Power Networks and Smart Grid**: In this project we used graph-theoretic approaches to design robust methods for power grid extension in places where renewable energy is located.
  - **Supervising Graduate Students:** As a part of my job, I helped graduate students in their research work as a co-supervisor.
- **Research Assistant (PhD Thesis), University of Toronto, Canada**, September 2003 - March 2009.
  - Design of AutoNet, an autonomic core network management system.
    - I designed a conceptual architecture (referred to as AutoNet) for autonomic (self-organizing, self-configuring, self-healing, self-optimizing) management of core networks.
    - The architecture consists of two autonomic control loops, the short-term loop for fast reaction to predicted and unpredicted events, and long-term loop to re-optimize the network resources.
    - Each customer receives a virtual network which is essentially a subset of resources assigned to the customer.
    - The autonomic control loops guarantee that the contracted service level agreement (SLA) for each customer is satisfied.
  - Quantifying the robustness of a network.

    - I designed a graph-theoretic metric (referred to as network criticality) to quantify the robustness of the network to the environmental changes (changes in traffic, topology, and community of interest).
    - I investigated the mathematical properties of network criticality. It is a strictly convex and decreasing function of network link weights.
  - Optimization of network robustness.
    - In AutoNet the robustness is optimized by minimizing network criticality via a convex optimization problem with appropriate constraints (such as total weight budget constraint and flow conservation constraints).
    - The optimization problem is investigated in detail and based on the properties of the optimal solution a numerical and iterative method for solving the optimization problem is developed.
  - Traffic engineering
    - A number of traffic engineering algorithms are designed to provide for the robust operation of the short-term autonomic loop in AutoNet (using the properties of the optimality gap of the convex optimization problem for minimizing network criticality).
    - Path Criticality Routing (PCR) algorithm as one of the proposed traffic engineering methods is implemented as a module in TOTEM (TOolbox for Traffic Engineering Methods), which is a open-source toolbox for traffic engineering purposes.
    - Virtual network assignment to the customers (based on their SLA) is achieved by exploiting the proposed traffic engineering methods.
  - Network planning.
    - A network (re)planning algorithm is designed for the long-term autonomic loop of AutoNet.
    - The proposed network planning algorithm is used to design robust power grid topologies.
  - Design of a self-organizing peer-to-peer (P2P) VoIP system based on Session Initiation Protocol (SIP).
- **Research Assistant (M.A.Sc Thesis), University of Tehran, Iran**, September 1992 - August 1994.
  - Design of an Intelligent Control for unknown industrial processes using neural networks and fuzzy logic.
    - The main idea was to use neural networks to build and optimize the IF and THEN parts of a fuzzy rule-base.

TEACHING EXPERIENCE

- **Adjunct Lecturer**
  - University of Toronto, Toronto, Canada, January 2012 - Present
    - Course (graduate): Service Provider Networks (ECE1524), Winter 2012
- **Sessional Instructor**
  - University of Ontario Institute of Technology (UOIT), Oshawa, Canada, September 2010, December 2011
    - Course (graduate): "Stochastic Processes" (ENGR 5610G), Fall 2011
    - Course (undergraduate): "Modern Control Systems" (ENGR 3100U), Winter (Spring) 2011.
    - Course (graduate / undergraduate): "Digital Communications" (ENGR 4130U), Fall 2010.
  - Azad University of Tehran, Department of Computer Science (CS), Tehran, Iran, 1996-1999.
    - Courses: "Algorithm Design" and "Design of High-Level Programming Languages".
    - Supervised 4 final undergraduate projects in different hardware and software areas.
  - Azad University of Saveh, Department of Electrical & Computer Engineering (ECE), Tehran, Iran, 1998-2001.
    - Courses: "Communication Systems I", "Communications Circuits", "Computer Networks".
  - Math courses for high school students, 1990, Tehran, Iran.
- **Lecturer and Lab Assistant.** Master of Engineering in Telecommunications (MET) program, University of Toronto, 2003 - 2008
  - Teaching several modules in MET program.
    - Networking concepts.

    - OPNET tutorial for MET students.
    - Lab assignments for MET students (average of 10 Lab assignments per academic year)

- **Teaching Assistant**
  - ECE302: Probability and Random Processes, Prof. Brendan Frey , Fall 2004, University of Toronto.
  - ECE361: Computer Networks, Prof. Alberto Leon-Garcia, Spring 2005, Spring 2006, Spring 2007, University of Toronto.
  - ECE316: Introductions to Communication Systems, Prof. Frank Kschischang, Fall 2005, Fall 2006, University of Toronto.
  - ECE385: Microprocessors, Prof. Steve Mann, Fall 2007, University of Toronto.
  - ECE298: System Design and Technical Communication, Prof. Hamid Teimourabadi, Fall 2007, University of Toronto.
  - ECE461: Internetworking, Prof. Alberto Leon-Garcia, Fall 2008, University of Toronto (substitute lecturer for 2 modules).
  - APS111: Engineering Strategies and Practices I, Prof. Hans Kunov, Fall 2007, Fall 2008, University of Toronto.
  - APS112: Engineering Strategies and Practices II, Prof. Hans Kunov, Spring 2008, Spring 2009, University of Toronto.
  - Neural Networks, Prof. Caro Lucas, Fall 1993, University of Tehran, Iran.

WORK EXPERIENCE

- **Network Consultant, TELUS Communications, Toronto, Canada**, July 2011 - Present
  - Modeling of TELUS converged edge network (CE) using OPNET and MATE as network modeling tools
  - Investigate the efficiency and robustness of TELUS CE network under different traffic trending strategies and failure scenarios
  - Preparing a proposal for best available network modeling tools for different parts of TELUS network (such as LTE).
- **Network Architecture Lab (NAL) Supervisor,University of Toronto, Canada**, September 2003 - Present.
  - Running NAL for researchers in Prof. Leon-Garcia's group.
    - Series of networking lab assignments for students in MET program (Master of Engineering in Telecommunications), and undergraduate students (course: ECE461).
    - Series of OPNET lab assignments for MET students.
    - General lab assistance for graduate students.
    - Supervising more than 50 undergraduate students during the summers (600-hour obligatory undergraduate work load, fourth year undergraduate project, or volunteer summer job)
    - Maintenance of IBM blade cluster (server farm) with 112 nodes.
- **Networking Lab Setup (Summer Job)**, May 2003 - August 2003.
  - Setup of the Network Architecture Lab (NAL), the networking and VoIP lab for researchers in Prof. Leon-Garcia's research group. The main goal was to design a lab with enough networking facilities for both undergraduate and graduate students. I was responsible for purchasing appropriate devices and making them operational for lab users. Here is a list of important installed devices:
    - IBM blade cluster (server farm) with 112 nodes.
    - Routers and switches with different capabilities (mainly Cisco and Nortel).
    - A VoIP telephony rack including Nortel BCM IP-based PBX, Cisco Callmanager, VoIP phones, and gateway.
    - A Video rack for streaming purposes including cameras, streaming server, voice and video switcher.
    - Traffic generator and tester (IXIA).
    - Networking racks for MET (Master of Engineering in Telecommunications) program.
- **Senior Software Engineer, PAYA Communication Industries, Iran**, January 2001 - February 2003.

  - Design and implementation of a firmware to add/drop data on special time slots of a PCM highway in CARIN-2000 (a large-scale digital exchange). CARIN-2000 is widely deployed in different parts of Iran, Iraq, Turkey, Afghanistan.
  - Implementation of MTP3 layer of SS7 signaling (ITU-T Q704) for high capacity digital exchanges (CARIN-2000).
  - Implementation of v5.1 and V5.2 interfaces (ITU G964 and G965) in LE (Local Exchange) and AN (Access Network) sides.
- **Chief Executive Officer, Tiz-Payam-Pardaz, Iran** January 1999 - December 2000.
  - Design and implementation of switching mode power supplies and DC converters for Local Exchanges.
  - Billing software for rural Local Exchanges.
- **R&D Manager and Senior Software Engineer, Pars Telephone Kar, Iran** July 1992 - December 1998.
  - Design and implementation of call-control software for an analog PABX including all features.
  - Design and implementation of a custom Caller-Id phone for analog PABX.
  - Leading a team to design and implement PDX1, a medium-scale digital telephone exchange (won the prestigious innovation prize, referred to as Kharazmi prize) including:
    * Hardware part: line card, digital and analog trunks, switching and control boards, main processing module, basic rate ISDN module, master alarm panel.
    * Software part: call control, operation and maintenance (O&M), post-processing package for billing.

PROFESSIONAL MEMBERSHIPS

- **IEEE, Member** , 2003 - Present (Student Member 2003 - 2008).
- **IEEE, Communications Society**, 2003 - Present.
- **ACM, Member**, 2009 - Present.

PUBLICATIONS

JOURNAL

1. Naser Movahedinia, **Ali Tizghadam**, Alberto Leon-Garcia, "A Robust Approach for Joint Power Management, Spectrum Assignment and Routing in Cognitive Radio Using Network Criticality". To appear in (with minor modifications) *IEEE Transactions on Mobile Computing*, Manuscript ID: TMC-2010-08-0407.
2. **Ali Tizghadam**, Alberto Leon-Garcia, Hassan Naser, "On Network Criticality in Wireless Networks", To appear in *ACM SIGMETRICS Performance Evaluation Review (PER)*.
3. **Ali Tizghadam**, Alberto Leon-Garcia, "'Robust Network Planning in Nonuniform Traffic Scenarios", *Elsevier Computer Communications Journal, doi:10.1016/j.comcom.2010.12.013*, available online January 11, 2011.
4. **Ali Tizghadam**, Alberto Leon-Garcia, "'Betweenness Centrality and Resistance Distance in Communication Networks", *IEEE Network Magazine, vol. 24, no. 6, pages 10-16, November/December 2010*.
5. **Ali Tizghadam**, Alberto Leon-Garcia, "'On Random Walks in Direction-Aware Network Problems", *ACM SIGMETRICS Performance Evaluation Review (PER), Vol. 38, No. 2, pages 9-11, September 2010*.
6. **Ali Tizghadam**, Alberto Leon-Garcia, "Autonomic Traffic Engineering for Network Robustness", *IEEE Journal of Selected Areas in Communications (J-SAC), vol. 28, no. 1, pages 39-50, January 2010*.
7. Yu Cheng, Ramy Farha, **Ali Tizghadam**, Myung Sup Kim, Massoud Hashemi, James Won-Ki Hong, Alberto Leon-Garcia, "Virtual Network Approach to Scalable IP Service Deployment and Efficient Resource Management", *IEEE Communications Magazine, vol. 43 no. 10, pages 74-84, October 2005*.

BOOK CHAPTERS AND EDITED VOLUMES

8. **Ali Tizghadam**, Alireza Bigdeli, Alberto Leon-Garcia, Hassan Naser, "'Joint Optimization of Resources and Routes: From Communication Networks to Power Grids", To appear in *Handbook of Optimization in Complex Networks*, My T. Thai and Panos Pardalos (Eds.), Springer (first quarter of 2011).
9. **Ali Tizghadam**, Alberto Leon-Garcia (2007), "A Robust Routing Plan to Optimize Throughput in Core Networks", *Managing Traffic Performance in Converged Networks*, Lorne Mason, Tadeusz Drwiega and James Yan (Eds.) Springer.

CONFERENCE

10. Alireza Bigdeli, **Ali Tizghadam**, Alberto Leon-Garcia, "Survivable Routing Using Path Criticality", *International Conference on Computing, Networking and Communications, Network Algorithm & Performance Evaluation Symposium (ICNC-NAPE)*, Hawaii, USA, January 2012.
11. Alireza Bigdeli, **Ali Tizghadam**, Alberto Leon-Garcia, "On Capacity Planning for Minimum Vulnerability", *International Workshop on the Design of Reliable Communication (DRCN)*, Krakow, Poland, October 2011.
12. **Ali Tizghadam**, Alireza Bigdeli, Alberto Leon-Garcia, "k-Robust Network Design Using Resistance Distance: Case of RocketFuel and Power Grids", *Third IEEE INFOCOM Workshop on Network Science for Communications (NetSciCom)*, Shanghai, China, April 2011.
13. Naser Movahedinia, **Ali Tizghadam**, Alberto Leon-Garcia, "'A Robust Power Control Method for Cognitive Radio Networks", *IEEE Globecom Workshop on Broadband Wireless Access*, Miami, USA, December 2010.
14. **Ali Tizghadam**, Alberto Leon-Garcia, "On Random Walks in Direction-Aware Network Problems", *Twelfth ACM SIGMETRICS Workshop on Mathematical Performance Modeling and Analysis (MAMA)*, New York, USA, June 2010.
15. **Ali Tizghadam**, Alberto Leon-Garcia, "On Traffic-Aware Betweenness and Network Criticality", *Second IEEE INFOCOM Workshop on Network Science for Communications (NetSciCom)*, San Diego, USA, March 2010.
16. **Ali Tizghadam**, Alberto Leon-Garcia, "On Robust Network Planning", 7^{th} *International Workshop on the Design of Reliable Communication (DRCN)*, Washington DC, USA, October 2009.
17. **Ali Tizghadam**, Alberto Leon-Garcia, "A Graph Theoretical Approach to Traffic Engineering and Network Control Problem", 21^{th} *International Teletraffic Congress (ITC21)*, Paris, France, September 2009.
18. Alireza Bigdeli, **Ali Tizghadam**, Alberto Leon-Garcia, "Comparison of Network Criticality, Algebraic Connectivity, and Other Graph Metrics", *NetSci Workshop on Simplifying Complex Networks (SIMPLEX)*, Venice, Italy, July 2009.
19. **Ali Tizghadam**, Alberto Leon-Garcia, "Survival Value of Communication Networks", *IEEE INFOCOM Workshop on Network Science for Communications (NetSciCom)*, Rio de Janeiro, Brazil, April 2009.
20. **Ali Tizghadam**, Alberto Leon-Garcia, "On Robust Traffic Engineering in Core Networks", *IEEE GLOBECOM*, New Orleans, USA, December 2008.
21. **Ali Tizghadam**, Alberto Leon-Garcia, "On Congestion Control in Mission Critical Networks", *IEEE INFOCOM Workshop on Mission Critical Networks (MCN)*, Phoenix, April 2008.
22. **Ali Tizghadam**, Alberto Leon-Garcia, "AORTA: Autonomic Network Control and Management System", *IEEE INFOCOM Workshop on Autonomic Network Management (ANM)*, Phoenix, April 2008.
23. **Ali Tizghadam**, Alberto Leon-Garcia, "LSP and Backup Path Setup in MPLS Networks based on Path Criticality Index", *IEEE ICC*, Glasgow, Scotland, June, 2007.
24. Khashayar Khavari, Chuen Liang, **Ali Tizghadam**, Farid Fadaie, Nadeem Abji, Ramy Farha, Alberto Leon-Garcia, "Unstructured Peer-to-Peer Session over IP using SIP", *IEEE IPCCC*, Phoenix, USA, April, 2006.
25. Khashayar Khavari, Nadeem Abji, Ramy Farha, Chuen Liang, **Ali Tizghadam**, Farid Fadaie, Alberto Leon-Garcia, "Structured Peer-to-Peer Control Plane", *IEEE ICC*, Istanbul, Turkey, June, 2006.
26. Myung Sup Kim, **Ali Tizghadam**, Alberto Leon-Garcia, James Won-Ki Hong, "Virtual Network based Autonomic Network Resource Control and Management System", *IEEE GLOBECOM*, St. Louis, USA, November 2005.
27. **Ali Tizghadam**, Massoud Hashemi, Alberto Leon-Garcia, "Investigation of Ant Colony Algorithm in Multiple Traffic Flow Environments", *IEEE CCECE*, Saskatoon, Canada, May 2005.
28. **Ali Tizghadam**, Caro Lucas, "Constructing a Fuzzy Rule-Base with RBF and MLP Neural Networks", *IASTED*, Zurich, Switzerland, July 1994.

PENDING PUBLICATIONS

29. "Network Science for Communications", with Alberto Leon-Garcia. Book in preparation.
30. Naser Movahedinia, **Ali Tizghadam**, Alberto Leon-Garcia, "Planning for Maximum Robustness and Minimum Vulnerability", Submitted to *IEEE Transactions on Network Service Management (TNSM)*, Manuscript ID TNSM-2011-00209.

31. Alireza Bigdeli, **Ali Tizghadam**, Alberto Leon-Garcia, "Survivable Routing Using Path Criticality", *International Conference on Computing, Networking and Communications, Network Algorithm & Performance Evaluation Symposium (ICNC-NAPE)*, Hawaii, USA, January 2012.
32. Weiwei Li, **Ali Tizghadam**, Alberto Leon-Garcia, "A Robust Clustering Algorithm for VANETs Based on Network Criticality". In Submission to *ITC 24*, Krakow Poland, September 2012.

INVITED TALKS (Selected)

1. "Network Modeling in Service Provider's Domain", *Technology Strategy Department, TELUS Communications*, Toronto, Canada, November 2011.
2. "Robust Network Design Using Network Criticality", *Minnesota State University*, Mankato, USA, June 2011.
3. "Network Science", *Center for Computational Biology and Bioinformatics, Columbia University*, New York, USA, March 2011.
4. "Applications of Network Science: From Communication Networks to Power Grids", *Department of Electrical and Computer Engineering, University of Victoria*, Victoria, Canada, January 2011.
5. "Applications of Network Science in Wireless Networks", *Department of Software Engineering, Lakehead University*, Thunder Bay, Canada, January 2011.
6. "Network Science for Communications", *School of Information Sciences, University of Pittsburgh*, Pittsburgh, USA, March 2010.
7. "Network Science for Communications", *Department of Electrical and Computer Engineering, McGill University*, Montreal, Canada, March 2010.

LANGUAGES

Proficient in English and Farsi. Working knowledge of French.

SERVICE

- Technical Program Committee (TPC) - *International Conference on Computing, Networking and Communications (ICNC'12), the Network Algorithms and Performance Evaluation (NAPE).*
- Reviewer (Journals) - *IEEE Transactions on Network and Service Management (TNSM), IEEE Communications Magazine, IEEE Journal on Selected Areas in Communications (J-SAC).*
- Reviewer (Conferences) - *Globecom 2010, Globecom 2009, QBSC 2008, ICC 2008, INFOCOM MCN 2008, Globecom 2006, CAMAD 2006, Networking 2005, MMNS 2004*

TECHNICAL SKILLS

- **Protocols:** MPLS and DiffServ, TCP/IP, PPP, HDLC, WDM, Frame Relay, RS232, RIP, IGRP, OSPF, EIGRP, Spanning-Tree, VoIP protocols (SIP, H323), SS7, ISDN, V5.1 & V5.2.
- **Development Tools:** OPNET, MATE, WINDL, MICROTEC (Mentor Graphics Toolkit for Motorola 68k series), WINIDE C-Cross compiler, TEMIA-966 signalling tester (V5.x & SS7), IXIA IP router tester.
- **Computing Tools:** MATLAB, Mathematica
- **Networking and Telecom Technologies:** Routers, Switches, VoIP Telephony Systems.
- **Embedded Micros:** Motorola 68K, Intel 86X, Z80.
- **Platforms:** Linux , MAC, Windows XP.
- **Programming Languages:** C, C++, Turbo Vision Library, Assembly (x86, Motorola 68k , z80).

REFERENCES

Available upon request.