Ashwin Shirsat

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Executive Summary

Ph.D. candidate trained in the intersecting fields of **electrical energy engineering**, **operations research**, and **data analytics**, with strong communication and research skills and the ability to work independently or as part of a team. Deep interest in the domain of **data-driven learning** and **optimal decision-making under uncertainty** for smart grid operations. Presently looking for **full-time** research opportunities in the electric energy systems starting **August 2022**. Long-term goal is to work towards creating sustainable power generation and distribution solutions by the application of smart technologies and advanced control mechanisms.

Education

- **North Carolina State University** — Raleigh, NC, USA
  Doctor of Philosophy in Electrical Engineering; GPA: 3.87 — *Aug. 2018 – Present*
- **Georgia Institute of Technology** — Atlanta, GA, USA
  Master of Science in Electrical and Computer Engineering; GPA: 3.83 — *Aug. 2016 – May 2018*
- **Veermata Jijabai Technological Institute** — Mumbai, MH, India
  Bachelor of Technology in Electrical Engineering; GPA: 4.00 — *July 2012 – May 2016*

Skill Set

- **Tools and Software Packages**: MATLAB, Simulink,NI Multisim, Scilab, OpenDSS, PowerWorld, WinIGS, Landis+Gyr AGA, FEMM, JMAG, PRO ENGINEER (PRO/E), AutoCAD, Cadence OrCAD, QGIS.
- **Programming Languages**: Python, R, Java, C, C++, Julia.
- **Optimization Tools/Solvers**: AMPL, ILOG CPLEX, CVXOPT, Python-IPOPT.
- **Frameworks**: NumPy, SciPy, Pandas, Tensorflow, Keras.
- **Operating System**: Windows, macOS, Linux.
- **Database**: MongoDB.
- **Version Control**: Git.

Research Experience

- **North Carolina State University** — Raleigh, NC, USA
  Graduate Research Assistant — *Aug. 2018 – Present*
  - **Photovoltaic analysis and response support platform for solar situational awareness and resiliency services (Tools: Matlab, Python, IBM CPLEX, OPAL-RT)**:
    - Developed algorithms to optimally provide grid support functionality to isolated distribution networks with high PV penetration during emergency situations.
    - Objective of this U.S. Department of Energy sponsored project is to ensure limited, but continuous operation of the distribution network during extended duration faults under extreme uncertainty.
    - Proposed a novel three stage multi-timescale hierarchical approach for the optimal proactive scheduling and operation of the distribution network.
    - The proposed energy management framework emphasized on developing novel techniques to mitigate impacts of forecast error and other uncertainties, prioritize critical load, and have low computation burden to ensure continuous optimized real-time dispatch under time intervals of five minutes.
    - The framework was validated in a hardware-in-loop environment.
  - **Data-driven stochastic model predictive control for home energy management systems (Tools: Python, R, IBM CPLEX)**:
    - Developed a stochastic model predictive control-based real-time energy management system for residential DC-coupled PV-storage systems.
    - Incorporated a multivariate Markov chain-based approach and a Bayesian-based Markov chain learning algorithm to model the uncertainty.
    - Results demonstrate a superior performance over the conventional methods in terms of uncertainty modeling, computation complexity, and operation cost reduction of around 7%.

- **Data driven optimal customer targeting for demand response (Tools: Matlab, Python, IBM CPLEX)**:
  - Designed a data-driven approach using mixture density recurrent neural networks to quantify the customer behavior.
  - Formulated a risk constrained stochastic knapsack problem for targeting the right set of customers and making informed load reduction bids.

Industrial Experience

- **Mitsubishi Electric Research Laboratories** Cambridge, MA, USA
  Research Intern *May 2021 – Aug. 2021*
  - **Deep learning-based distribution network energy disaggregation (Tools: Python, Matlab)**:
    - Developed a novel deep-learning model to perform feeder-level energy disaggregation using. Performed disaggregation of the feeder-level net-load data into the PV generation and native load component.
    - Proposed an approach to enable model training on synthetic data and application on actual system data to circumvent the insufficiency of real-world distribution grid-level data for training.
- **Landis+Gyr** Alpharetta, GA, USA
  Advanced Grid Analytics Intern *May 2017 – Dec. 2017*
  - **Leveraging AMI data for developing and enhancing asset mapping, network connectivity, and system health monitoring tools (Tools: Java, R, MongoDB, OpenDSS, L+G AGA)**:
    - Designed and implemented algorithms to analyze, validate, and manipulate the transformer-meter mapping, and monitor the operational health of distribution system Volt-VAR assets using AMI data.
  - **Modeling a distribution system for an electric utility (Tools: Java, MongoDB, QGIS)**:
    - Modeled a radial and meshed distribution system for a North-American and European electric utility.
    - Established asset connectivity from utility GIS data and assisted in developing Java adapters to translate the utility data into a distribution system network connectivity model.

Projects

- **Adaptive Control**: A comparative study of direct and indirect adaptive control techniques for three-phase grid connected inverter operation.
- **Power Grid Resilience**: Data analysis for studying weather impacts on energy distribution infrastructure.
- **Home Energy Management System (HEMS)**: Hardware implementation of a smart HEMS using real time price as control signal.
- **Power Flow Analysis**: A comparative study of two power flow techniques, i.e., Newton Raphson method and quadratized method.

Publications

- **Ashwin Shirsat** and Wenyuan Tang, "Data-Driven Stochastic Model Predictive Control for DC-Coupled Residential PV-Storage Systems," IEEE Transactions on Energy Conversion, 2021.
- **Ashwin Shirsat** and Wenyuan Tang, "Quantifying Residential Demand Response Potential Using a Mixture Density Recurrent Neural Network," International Journal of Electrical Power & Energy Systems, 2021.
- **Ashwin Shirsat**, et al. "Hierarchical Multi-timescale Framework For Operation of Dynamic Community Microgrid," IEEE PES General Meeting (PESGM), Washington DC, USA, 2021.
- **Ashwin Shirsat** and Wenyuan Tang, "Sensitivity analysis of time-of-use rates on operations of home energy management systems," IEEE PES General Meeting (PESGM), Montreal, QC, Canada, 2020.
- Junkai Liang, **Ashwin Shirsat**, and Wenyuan Tang, "Sustainable Community Based PV-Storage Planning Using Nash Bargaining Solution," International Journal of Electrical Power & Energy Systems.
- **Ashwin Shirsat** and Wenyuan Tang, "Identification of the Potential of Residential Demand Response Using Artificial Neural Networks," 2019 North American Power Symposium (NAPS), Wichita, KS, 2019

Patents

- Vivek Joshi and **Ashwin Shirsat**. "Volt-var device monitor." U.S. Patent Application No. 17/209,510.