



**FLORIDA
ATLANTIC
UNIVERSITY**

College of Engineering and Computer Science

Office of the Dean

777 Glades Road, EE96, Room 308

Boca Raton, FL 33431

561.297.3400

Announces the Ph.D. Dissertation Defense of

Jhansi Xavier

for the degree of Doctor of Philosophy (Ph.D.)

HYBRID FRAMEWORK FOR SYNTHETIC TRANSPORTATION NETWORK GENERATION: COMBINING CONSTRAINT-FIRST TOPOLOGY WITH LEARNED GEOMETRY

Sep 09-2026, 11:00 AM

Virtual Zoom

777 Glades Road

Boca Raton, FL

DEPARTMENT: Department of Electrical Engineering and Computer Science

ADVISOR: Dr. Kwang Soo Yang

PH.D. SUPERVISORY COMMITTEE: Dr. Mihaela Cardei, Dr. Behnaaz Ghoraani, Dr. Zhen Ni,

ABSTRACT OF DISSERTATION: GIVEN A SET OF TRANSPORTATION NETWORK GRAPHS CONSISTING OF NODES AND ROAD SEGMENTS, THE GOAL OF SYNTHETIC TRANSPORTATION NETWORK GENERATION (STNG) IS TO GENERATE NEW NETWORKS THAT ARE BOTH TOPOLOGICALLY VALID AND GEOMETRICALLY REALISTIC. THIS PROBLEM IS IMPORTANT BECAUSE ROAD NETWORKS MUST SATISFY HARD TOPOLOGICAL CONSTRAINTS—SUCH AS PLANARITY, CONNECTIVITY, AND BOUNDED INTERSECTION DEGREE WHILE ALSO CAPTURING THE GEOMETRIC DIVERSITY OF REAL-WORLD ROAD CURVATURE. EXISTING APPROACHES FACE A FUNDAMENTAL CHALLENGE: RULE-BASED METHODS GUARANTEE STRUCTURAL VALIDITY BUT PRODUCE INFLEXIBLE STRUCTURES, WHEREAS END-TO-END LEARNED METHODS CAPTURE REALISTIC GEOMETRY BUT FREQUENTLY VIOLATE TOPOLOGICAL CONSTRAINTS. WE PROPOSE HYBRIDSTNG, A CONSTRAINT-FIRST HYBRID FRAMEWORK THAT ADDRESSES THIS CHALLENGE BY SEPARATING TOPOLOGY GENERATION FROM GEOMETRY SYNTHESIS. THE FRAMEWORK GENERATES A VALID NETWORK TOPOLOGY AND LEARNS REALISTIC ROAD CENTERLINE GEOMETRY ALIGNED WITH REAL-WORLD CURVATURE STATISTICS. EXPERIMENTS ON REAL-WORLD DATA ACROSS CITIES WITH DISTINCT URBAN MORPHOLOGIES SHOW THAT HYBRIDSTNG ACHIEVES COMPLETE TOPOLOGICAL VALIDITY WHILE SIGNIFICANTLY OUTPERFORMING RULE-BASED AND LEARNED BASELINES IN GEOMETRIC REALISM.

BIOGRAPHICAL SKETCH : **JHANSI XAVIER** IS A SENIOR SOFTWARE ENGINEER, TECHNICAL LEAD, AND SOLUTION ARCHITECT WITH OVER 15 YEARS OF EXPERIENCE IN ENTERPRISE SOFTWARE ENGINEERING, CLOUD PLATFORMS, AND DIGITAL TRANSFORMATION. HE IS CURRENTLY PURSUING A PH.D. IN COMPUTER SCIENCE AT FLORIDA ATLANTIC UNIVERSITY, WITH RESEARCH FOCUSED ON AI SYSTEMS, CONSTRAINT-AWARE ARCHITECTURES, GENERATIVE AI, AND TRANSPORTATION NETWORK OPTIMIZATION. JHANSI HAS AUTHORED AND CO-AUTHORED MULTIPLE PEER-REVIEWED RESEARCH PUBLICATIONS AND ACTIVELY CONTRIBUTES TO BRIDGING ACADEMIC RESEARCH WITH REAL-WORLD ENGINEERING PRACTICES. HIS WORK FOCUSES ON ADVANCING RELIABLE, SCALABLE, AND GOVERNED AI SOLUTIONS FOR ENTERPRISE ENVIRONMENTS.



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CONCERNING PERIOD OF PREPARATION
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Published Papers:

- Hybrid Framework for Synthetic Transportation Network Generation: Combining Constraint-First Topology with Learned Geometry- July 31, 2026, IEEE Open Access, 10.1109/ACCESS.2026.3716667
- AWS Resilient Pattern: Implementing Change Data Capture with Reduced Data Loss, Apr 2025 — International Journal of Advanced Research in Science Communication and Technology
- Azure Edge Computing: Enhancing IoT Deployments with Microsoft Azure, Apr 2025 — International Journal of Advanced Research in Science Communication and Technology