UCF | Institute for Simulation and Training — IST

Imagining and Building Tomorrow's Worlds

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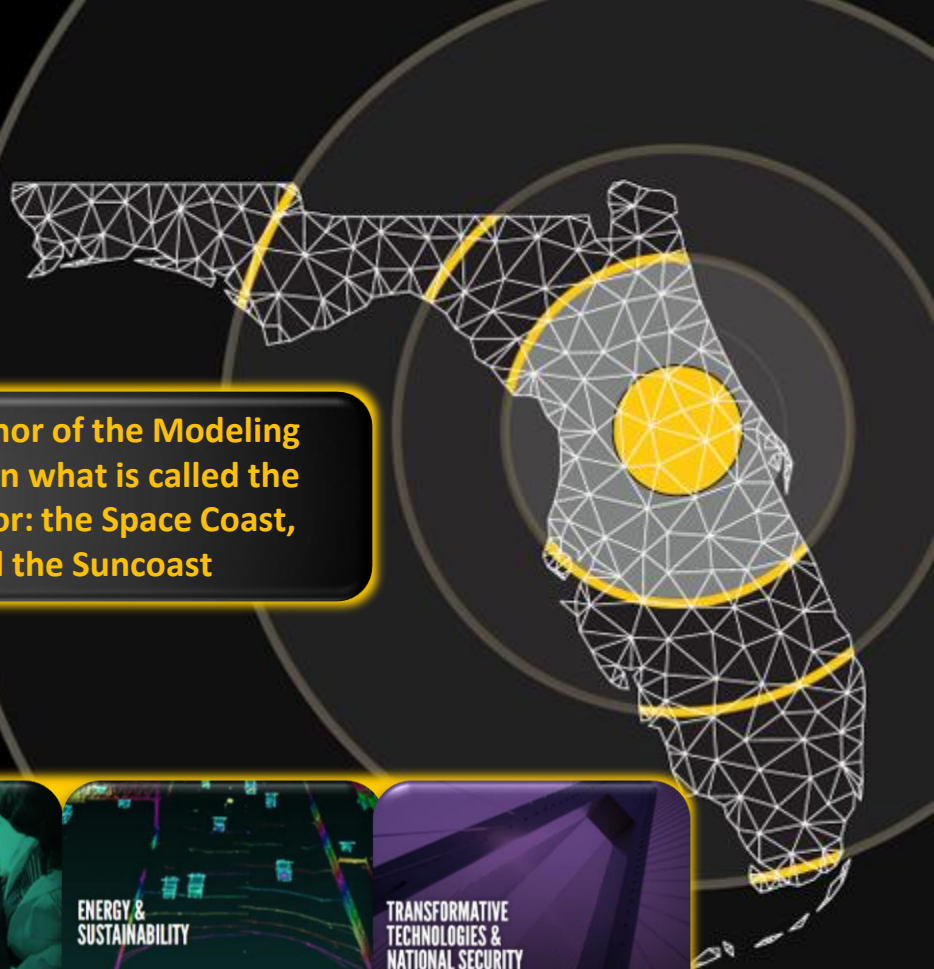


UCF is the Academic Anchor of the Modeling and Simulation Industry in what is called the Florida High-Tech Corridor: the Space Coast, Central Florida, and the Suncoast

AREAS OF FOCUS

Epicenter for Modeling & Simulation Excellence

AT A GLANCE

More than $8B in Defense Spending in MS&T

200+ Large & Small Businesses within 10 miles

More than 72,000 UCF Students

Institute for Simulation and Training (IST)

- World-renowned expertise in modeling, simulation and training for over 40 years
- Mission: to develop cutting-edge tools, processes, knowledge and systems to solve significant challenges and drive innovation in simulation and training
- Tightly coupled with Defense, Aerospace, Federal Government and Industry, including Energy and Healthcare
- Integrated state-of-the-art laboratories
- Leading UCF's Digital Twin Initiative
- Impact in transdisciplinary academic programs
  - Engineering, CS, Psychology, Mathematics, and More

Pegasus Research Institute (PRI): Leading the Way

ADVANCED TECHNOLOGY

VR/AR/XR

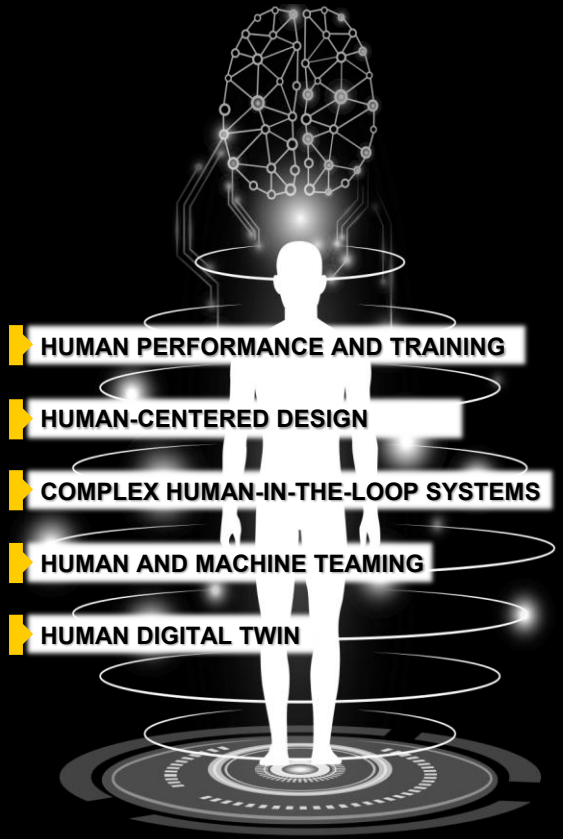
ADVANCED MODELING & SIMULATION

COMPUTATION, HPC, & DATA SCIENCE

DIGITAL HUMAN & NEUROCOMPUTING

EMERGING TECH: AI, QUANTUM

HUMAN-CENTERED RESEARCH



APPLIED RESEARCH AREAS

- DEFENSE & SPACE

- HEALTHCARE

- ENGINEERING

- EDUCATION

- SMART CITIES / INFRASTRUCTURE

- ENERGY

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CHALLENGES IN TODAY'S WORLD

Connected

Competition

Disruptive Innovation

Partnership

Complex

Global

Instability

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Very Relevant in Emergency Management

- Strong need to manage complexity in mission-critical time frames
- Enable fast “what if” for planning, response, and mitigation
- Support tighter intercommunication of stakeholders
- Predict problems before they happen
- Optimization and fast delivery of resources

Today in an Emergency We are Overloaded with Data

- Weather data:
  - Flood levels
  - Wind speeds
  - Ocean conditions
  - Temperatures
- Infrastructure data:
  - Power outages
  - Road Closures
  - Hospitals, shelters, emergency services
- Communications and alert data:
  - Emergency alerts: sirens, broadcasts
  - 911 logs and dispatch data
  - Social media posts
  - Community reports, crisis-reporting (311)
- Population and Health data:
  - Population density and location
  - Health infrastructure capacity
  - Evacuation data

- Resource and logistics data:
  - First responder locations
  - Ambulance, police, fire availability
  - Supply inventories
  - Transportation assets
- Damage assessment data:
  - Images and video from site
  - Satellite
  - Engineering assessment of infrastructure
- Coordination & policy data:
  - Incident action plans
  - Resource request and tasking logs
  - Funding and cost tracking
  - Interoperability communications

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Challenges

- Technical:
  - Heterogeneous data formats
  - Inconsistent data quality
  - Real-time processing
  - Lack of standardized metadata to help on data fusion & integration
- Organizational
  - Data silos between agencies and companies
  - Incompatible technology
  - Varying priorities across organizations
  - Lack of pre-established data-sharing agreements
- Legal, policy, privacy constraints:
  - HIPAA and other restrictions limiting who can access data
  - Liability: concern about data integrity, ownership and legal consequences
  - Jurisdiction boundaries
- Human:
  - Limited technical expertise on emergency operations personnel
  - High stress situations → revert to manual processes due to familiarity even if tools are available
  - Information overload
- Infrastructure:
  - Connectivity failures/overload
  - Remote vs on-site gaps
  - Cybersecurity
- Trust barriers:
  - Reluctance to share sensitive or incomplete information
  - Organizational culture on data control
  - Lack of trust on tools from others or centralized tools

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The Role of AI in These Challenges

- Technical:
  - Automated Data Cleaning & Harmonization
  - Real-Time Data Fusion
  - Anomaly Detection
- Cross- Organizational:
  - Intelligent interoperability layers
  - Automated summaries for decision makers
  - Knowledge gaps
- Legal, policy, & privacy:
  - Privacy-Preserving methods:
    - Differential privacy
    - Federated learning
    - Secure computation
  - Automated data access controls
    - Role-based
    - Audit trails
    - Masking sensitive fields
- Human:
  - Reduce Information overload
    - Highlight priorities
    - Cluster duplications
    - Flag emerging patterns
    - Conver raw data into recommendations for action
  - Decision support systems
    - Optimized evacuation routes and resource allocation
    - Provide staff strategies
    - Recommend shelter placement

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However, We Need to Change the Thinking

It is NOT only about the DATA

It IS about

INFORMATION

INSIGHT

PROCESSES

EXPLORATION

Dashboards: the “French Doors” into Data

Issues with Dashboards

Executive Information Systems

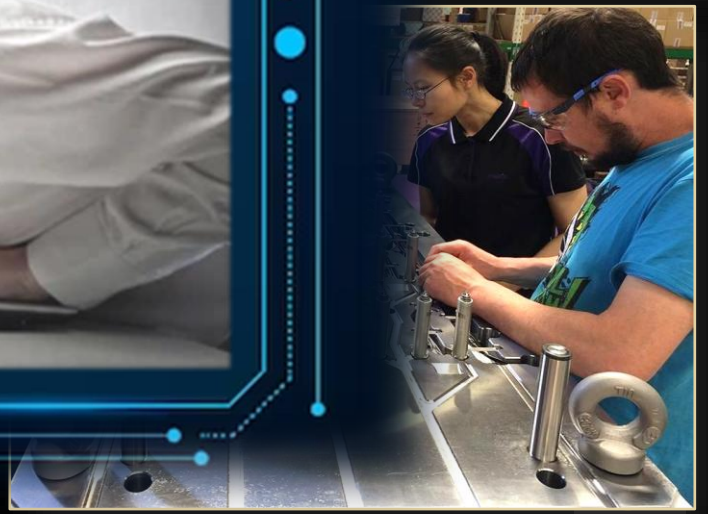
“Weapon of choice” to distribute data

Most dashboards are not actionable

Rely on humans to extract meaning

No context

So, what are we missing to have a common language?



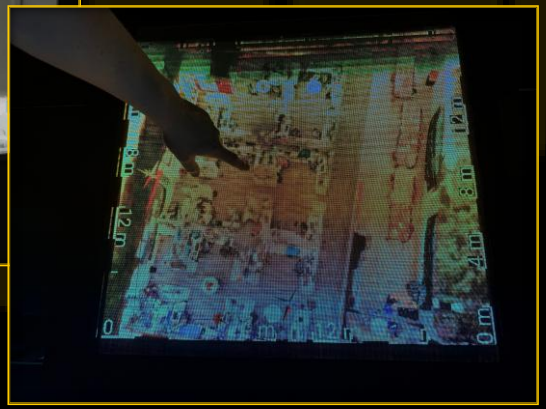
Let’s Think Visualization and Immersion

- Puts information in context
- Provides larger screen “real state” adding 3rd dimension
- Interactivity
- Common Language
- True Collaboration
  - Targeted to user roles

Urban Digital Twins & MicroLED Display

Cognitive Human Digital Twin:
Emotionally perceptive Conversational Agent
With Situational Awareness & Embodiment

Holographic Table & 3D table



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vDen (portable/consumer CAVE)

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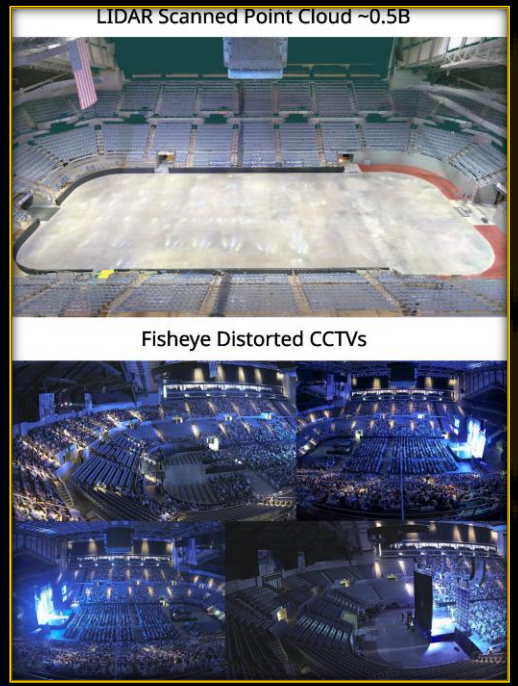
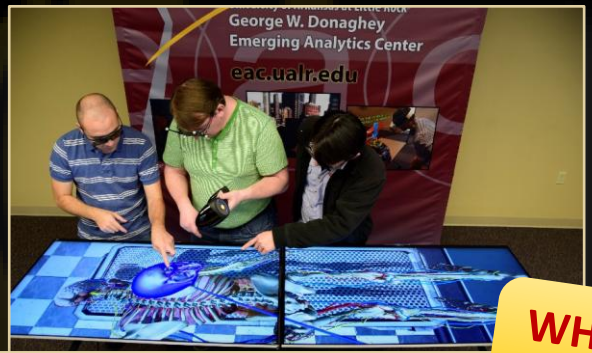
Drone-based Real-time Digital Twins update for Surveillance and Security

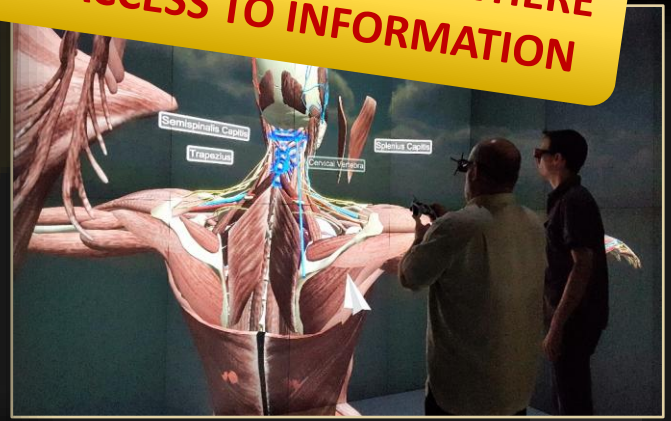
Live Video Updates and Efficient Rendering for LIDAR Models

Dr. Dirk Reiners, VARLab



A Scenario for the future





WHAT, HOW, WHY, WHEN, WHERE
I NEED ACCESS TO INFORMATION

SPACEU™

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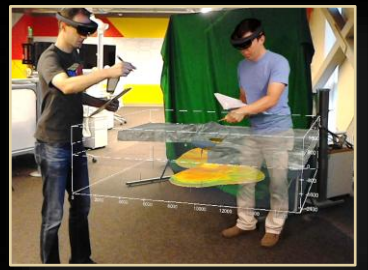

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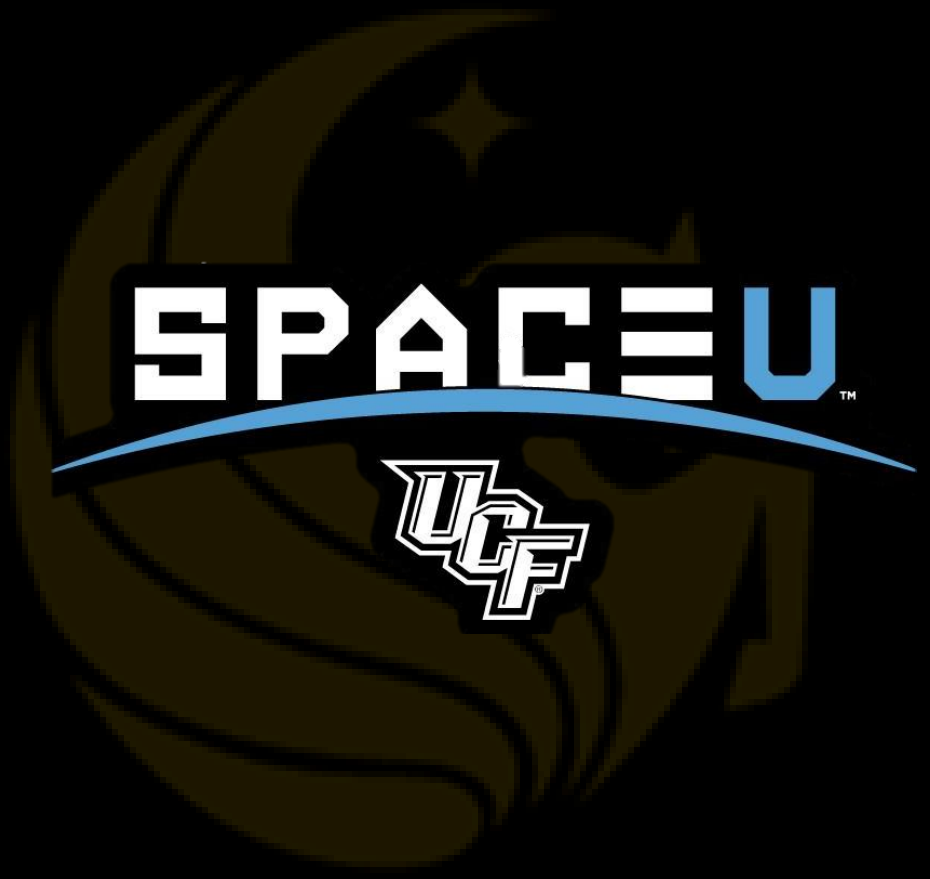

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