UMBC

ARTA
CENTER FOR ACCELERATED REAL TIME ANALYTICS

NSF Funded Industry/University Collaborative Research Center (IUCRC)

RUTGERS THE STATE UNIVERSITY OF NEW JERSEY
UMBC AN HONORS UNIVERSITY IN MARYLAND
UNIVERSITY OF MIAMI
ASU Arizona State University

NextGen Research @ UMBC

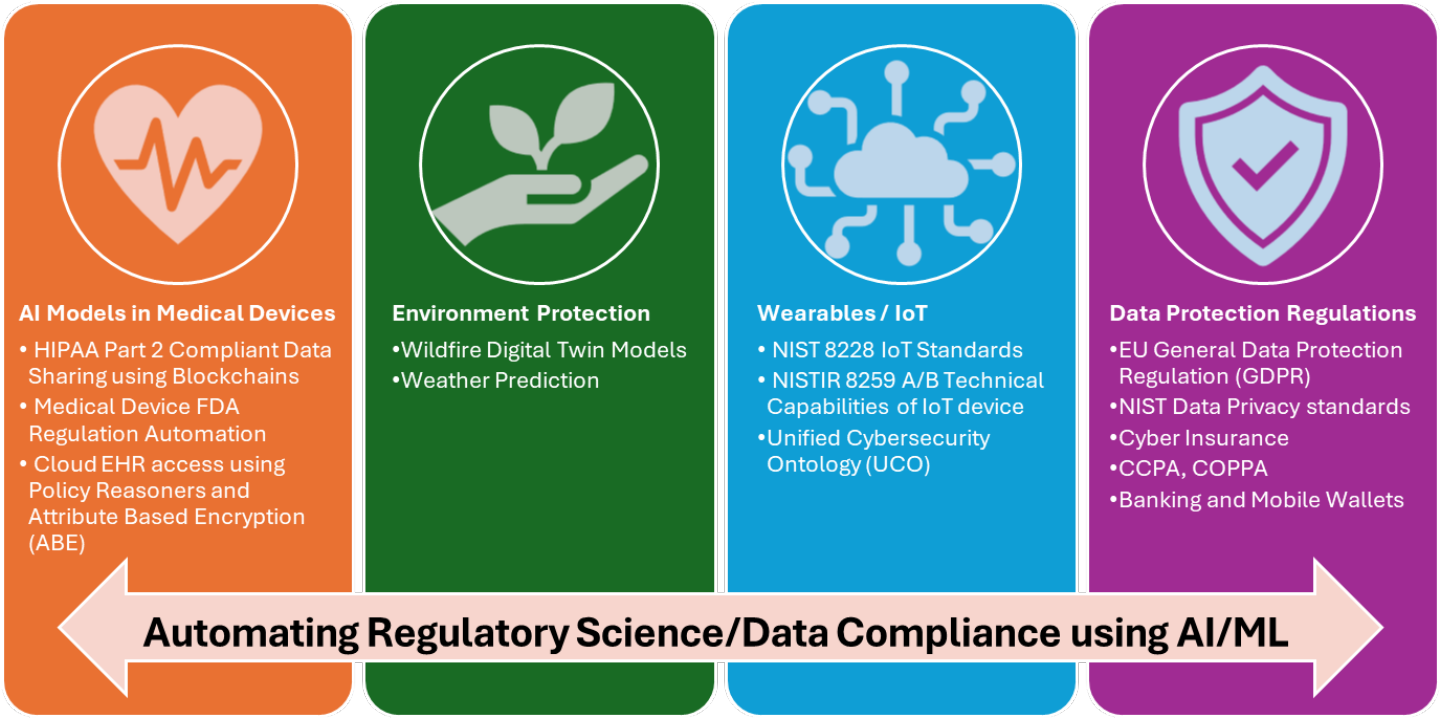
Dr. Karuna P Joshi
UMBC Director
Associate Professor, IS

Dr. Milton Halem
Senior Projects Manager
Research Professor, CSEE

UMBC

CARTA
CENTER FOR ACCELERATED REAL TIME ANALYTICS

Real Time Compliance by Design



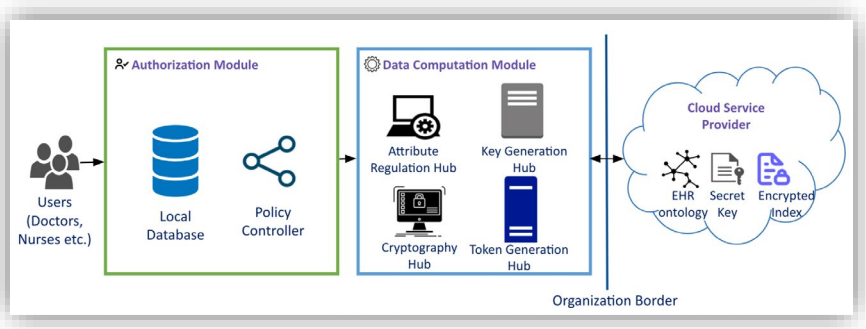
Contact **Karuna Joshi** (karuna.joshi@umbc.edu)

Publications available at **carta.umbc.edu**

UMBC

ARTA
CENTER FOR ACCELERATED REAL TIME ANALYTICS

Attribute based Access for Cloud EHRs

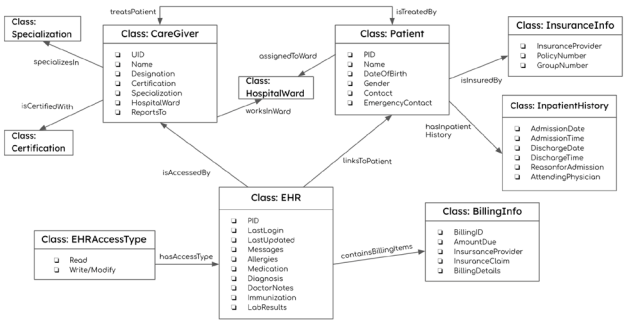


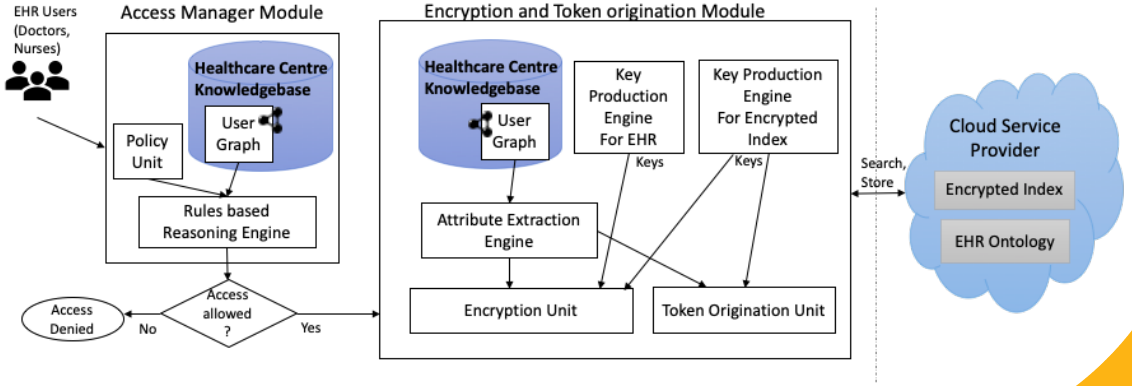
Secure CLOUD Electronic Health Record (EHR) that integrates Semantic Reasoners with Attribute Based Encryption (ABE)

- Fine-grained field-level access control
- Allows searching of encrypted records
- Revokes unwanted User attributes
- Handles data heterogeneity
- Flexible schema expansion
- Constant data retrieval performance

Dr. Karuna Joshi
Primary Investigator

EHR Knowledge Graph Database





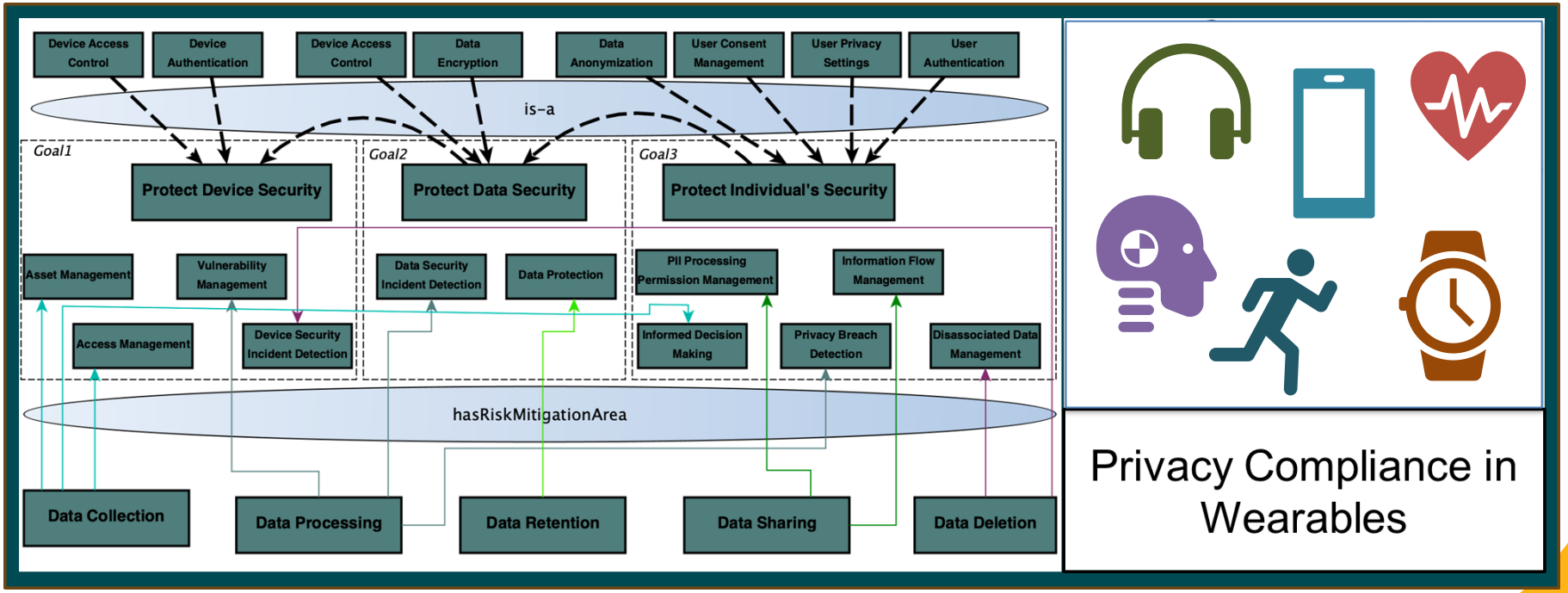
UMBC ARTA

CENTER FOR ACCELERATED
REAL TIME ANALYTICS

Securing Internet of Things (IoT)

Dr. Karuna Joshi, PI

AI/Knowledge graphs or Ontologies are used to enforce Real Time NIST 8228 compliance for IoT devices



Contact **Kelvin Echenim** (kelvine1@umbc.edu) **or Karuna Joshi** (karuna.joshi@umbc.edu)

Publications available at **carta.umbc.edu**

UMBC

ARTA
CENTER FOR ACCELERATED REAL TIME ANALYTICS

Optimizing Knowledge Graph Reasoning for High-Performance Computing (HPC)

Primary investigators

Dr. Anupam Joshi

Dr. Tim Finin

Initial evaluation of efficiency of semantic knowledge graph (KG) systems for large-scale, real-world datasets using HPC

- Hardware: AMD EPYC 7742 64-Core Processor, 2TB memory
- KG systems tested: Apache Jena, RDFox
- Initial data: Wikidata "truthy" dataset with ~1.3B triples
- SPARQL queries: different complexity of queries from wiki logs
- Metrics: query count, timeouts, error, average and median time

Jena

RDFOX
Oxford Semantic Technologies

WIKIDATA

SPARQL

Next tasks: explore ways to speed up queries, e.g.:

- Techniques for optimizing SPARQL queries
- Partition large graphs and query in parallel
- Precompute and store key relations
- Graph embeddings for approximate answers

```
PREFIX wd: <http://www.wikidata.org/entity/>
PREFIX wdt: <http://www.wikidata.org/prop/direct/>
SELECT ?x1
  {  wd:Q1656682 ((wdt:P279 | wdt:P31) / (wdt:P279* | wdt:P31*)) ?x1.}
```

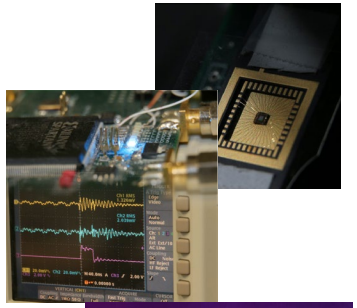

Contact **Tim Finin** (finin@umbc.edu) , **Anupam Joshi** (joshi@umbc.edu)

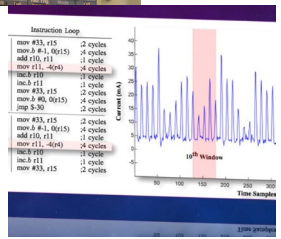
Publications available at **ebiquity.umbc.edu**

RISC-V Development, Benchmarking, and Assessment Platform

CENTER FOR ACCELERATED REAL TIME ANALYTICS

- Prototyping and Simulation/Benchmarking of RISC-V with workloads
- Compare Benchmarking Approaches in Simulation and FPGA Hardware
- Formal Verification of hardware-Software system behavior from code descriptions
- Custom-instructions for RISC-V architecture for FPGA and IC Design for reliable & performant edge processing
- Supporting FPGA coursework platform for RISC-V experimentation in hardware-software codesign
- Summer 2024: Hosting in-person gem5† simulator workshop at UMBC

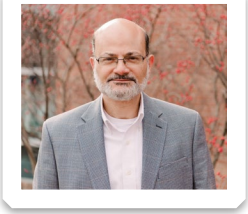




(†gem5.org)

Primary investigators

Dr. Ryan Robucci

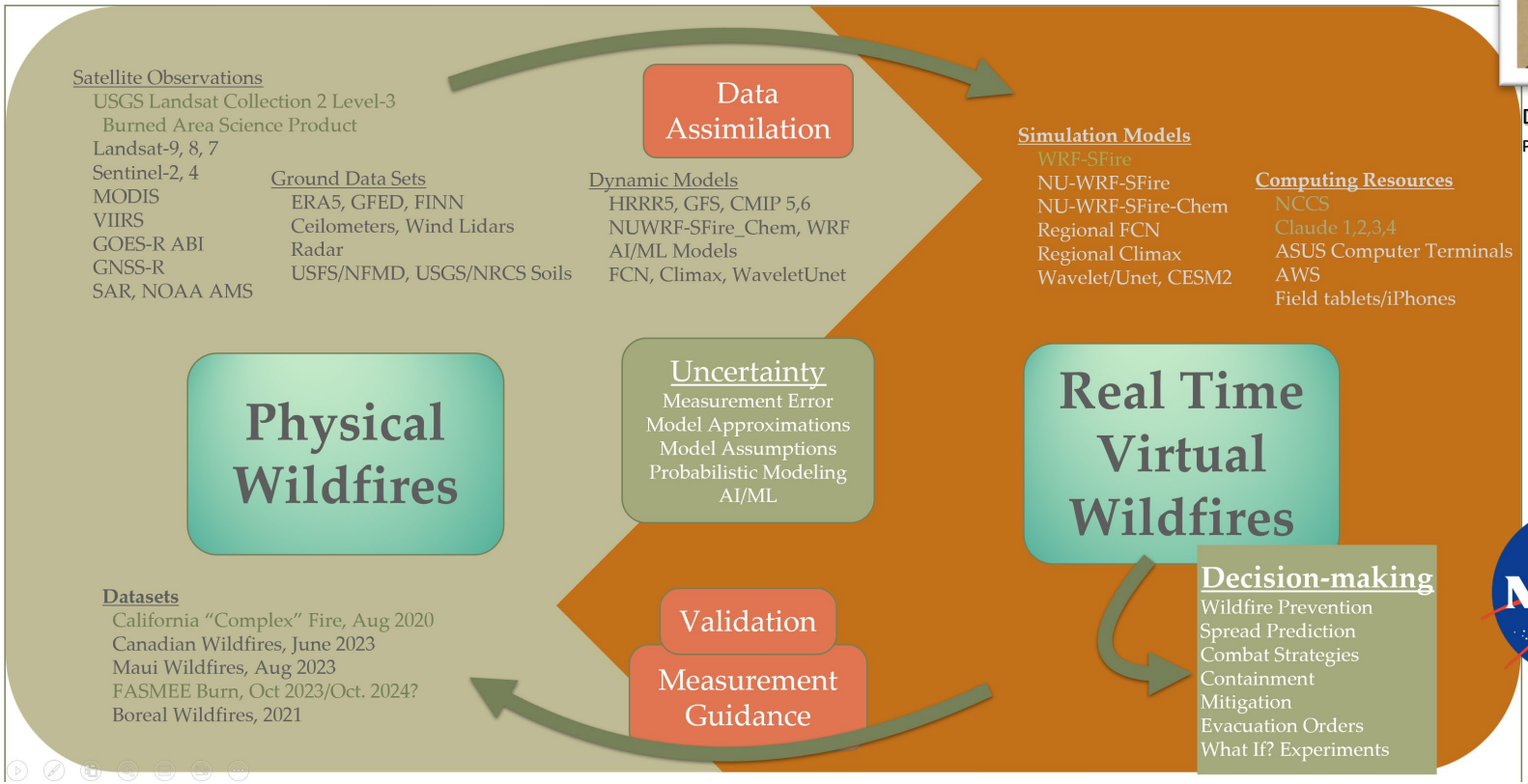


Dr. Mohamed Younis

Contact **Ryan Robucci** (robucci@umbc.edu) **Mohamed Younis** (younis@umbc.edu)

Wildfire Digital Twin Architecture

Dr. Milton Halem
Primary Investigator



Funded grant

UMBC

CARTA
CENTER FOR ACCELERATED REAL TIME ANALYTICS

Scientific Analysis using AI and Digital Twins

Dr. Milton Halem
Primary Investigator

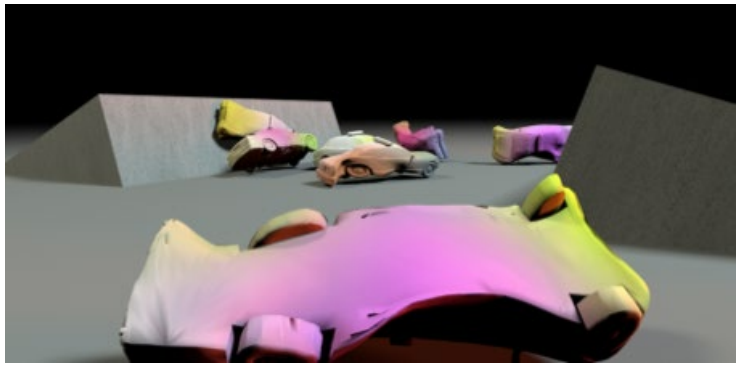
- NASA funded Wildfire Digital Twins
  - Developed Wildfire Digital Twin Architecture
  - Conducted NUWRF-SFire Digital Twin Forecast for August Complex (2020), Canadian Wildfires, Maui Wildfire
  - Ported NASA Unified Weather Research Forecast model to a Cluster
  - First (?) Hi-Res (5km) AI Regional Weather Forecast Model
- NOAA Air Quality AI based Forecast Bias Corrections
  - Developed AI based Bias Correction for CMAQ operational forecast
- CARTA NASA member AI based Projects
  - First Monthly mean Annual Forecast of Surface Temperature
  - Produced first AI-based OSSE (Observing System Simulation Exp.)

UMBC

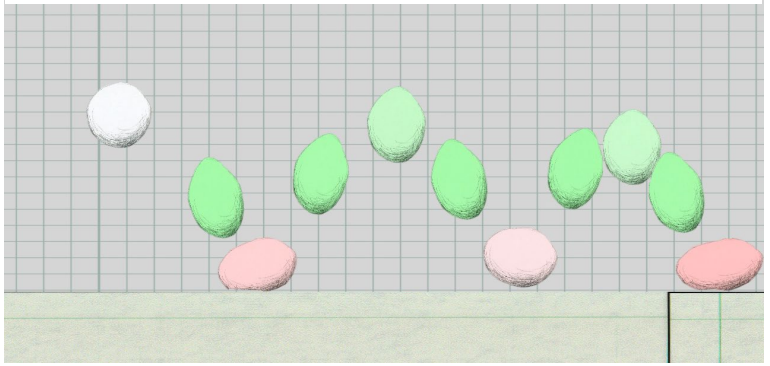
ARTA
CENTER FOR ACCELERATED REAL TIME ANALYTICS

Interactive Animation of Soft Bodies

Example-based Plastic Deformations

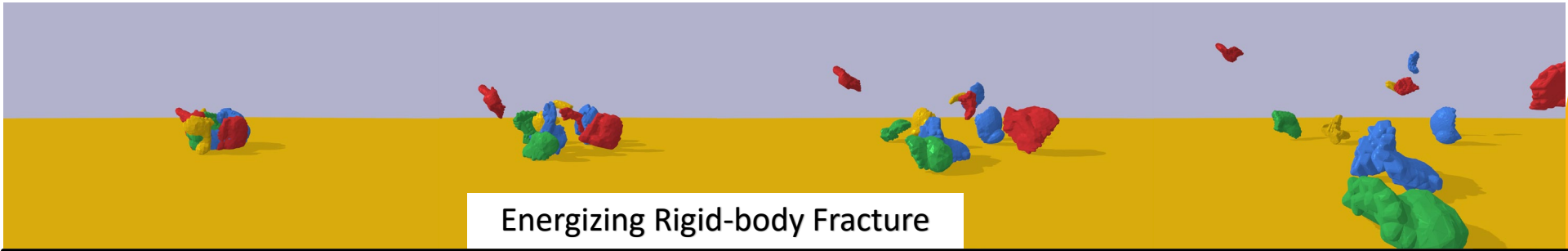


Dynamic Sprits



Dr. Adam Bargteil
Primary investigator

Physics + Scientific Computing + HCI + Visualization



Energizing Rigid-body Fracture

Contact **Adam Bargteil** (adamb@umbc.edu)

Blockchain for Supply Chain Asset Management and Data Security

- A permissioned blockchain system is being used as a way to instill true confidence in the data that is gathered by IoT devices. This imbues each IoT device with an identity that is immutable and traceable throughout its life.
- Having begun designing and implementing an architecture to augment the blockchain system with a distributed object storage system for bulk data storage, using the blockchain for maintaining metadata related to said data store.

Dr. Yaacov Yesha
and
Lawrence Sebald

UMBC

CARTA
CENTER FOR ACCELERATED REAL TIME ANALYTICS

Collaborate with Us

Dr. Karuna P Joshi
Karuna.joshi@umbc.edu

Dr. Milton Halem
Halem@umbc.edu

Dr. Anupam Joshi
joshi@umbc.edu

Dr. Tim Finin
finin@umbc.edu

Dr. Mohamed Younis
younis@umbc.edu

Dr. Ryan Robucci
robucci@umbc.edu

Dr. Adam Bargteil
adamb@umbc.edu

Dr. Yaacov Yesha
yayesha@umbc.edu

More Details available at

Carta.umbc.edu