CARTA – MIAMI CAPABILITIES AND ACCOMPLISHMENTS

UNIVERSITY OF MIAMI

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IDSC Innovation Officer | Head, International Relation
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Digital Health

- Software as a Device
- Healthy Aging
- Digital Therapeutics
- Music for Dementia
- Smart Homes with Health Nexus

Working on problems of national significance that have commercial value

Cyber Analytics

- Zero Trust Supply Chains
- Trusted Execution Environments
- Smart Contracts
- Blockchain-Powered Secure Data Exchange

UNIVERSITY OF MIAMI
FROST INSTITUTE
for DATA SCIENCE
& COMPUTING

enabling DISCOVERY

Empowering Innovation
NSF's Role in Softhread Inc.' start up journey

Dr. Yelena Yesha

UNIVERSITY OF MIAMI • Frost Institute for Data Science and Computing (IDSC)

Knight Foundation Endowed Chair of Data Science and AI

Building a Modular, Reliable, Scalable, and Secure Internet of Things Infrastructure

- Supported by: **NSF PFI Award 1919159, NSF CARTA Phase 1**

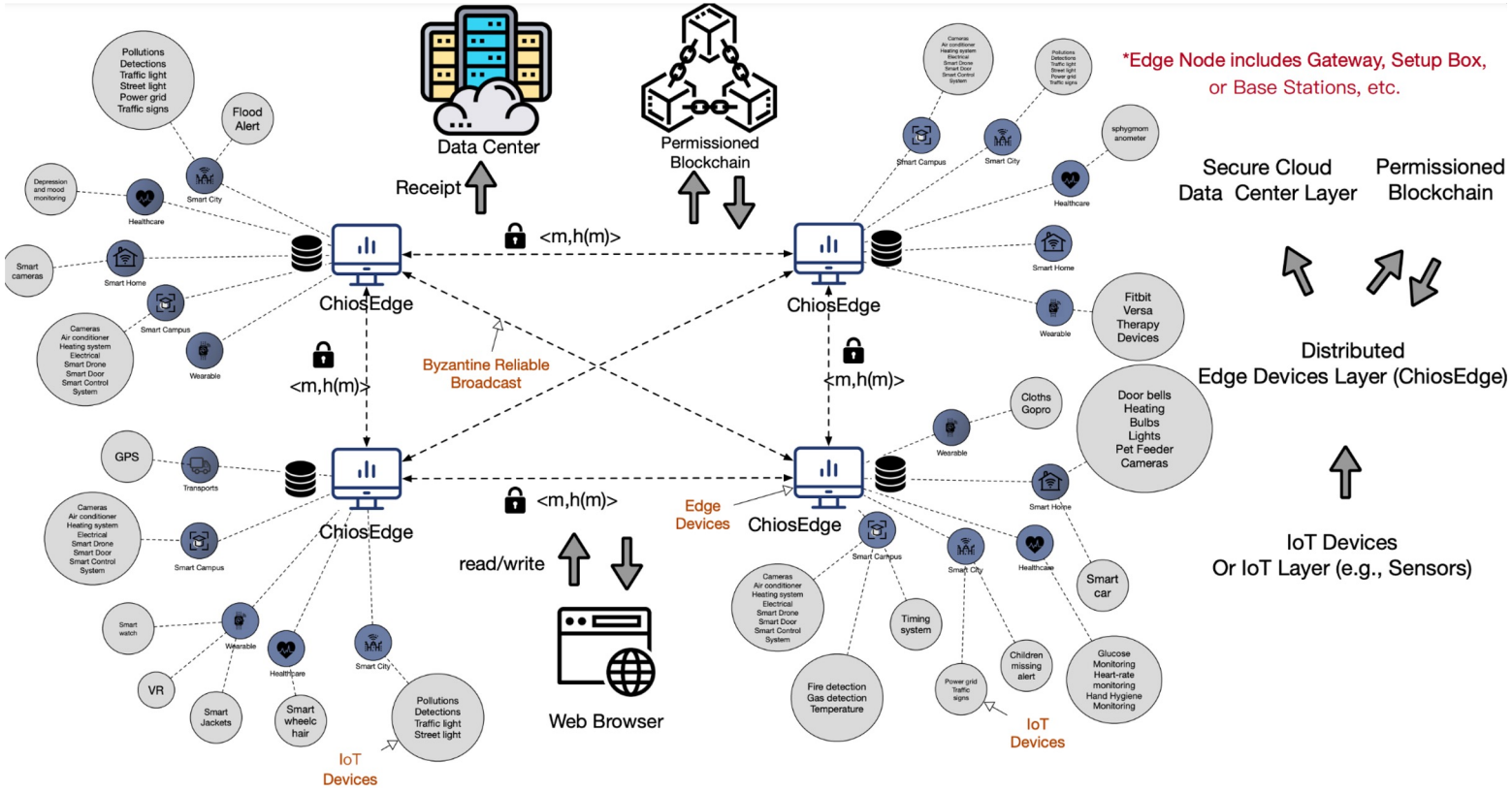
- Goals: Develop Chios and ChiosEdge for cost-effective, secure IoT infrastructure and establish a blockchain system enhancing data privacy as solution for various industries.

- Impact: The research has led to innovative IoT and blockchain solutions and the formation of Softhread Inc.

- **Softhread, Inc**.
  - Focused on deploying Chios™, a blockchain-powered and AI-enabled platform that enhances operational efficiency and data security.
  - The company's technologies: Combines blockchain, federated learning, and edge computing, Generative AI.
  - Ensures decentralized confidentiality and robust intrusion tolerance.
  - **Chios™** is not just a blockchain platform but a comprehensive ecosystem designed for scalability and security in IoT and healthcare.
  - **IP and Patents**: Robust portfolio including systems for secure blockchain infrastructure and precision medicine data exchanges.

Technological Breakthroughs with Chios, ChiosEdge

- **Chios:** an innovative permissioned blockchain platform specifically designed to enhance the security, scalability, and reliability of Internet of Things (IoT) infrastructures
- **ChiosEdge**: Advanced IoT framework with Byzantine Fault Tolerance, ensuring secure data replication.
- Translational Research to Product: Translation of research into Softhread products, with collaborations enhancing real-world applicability.

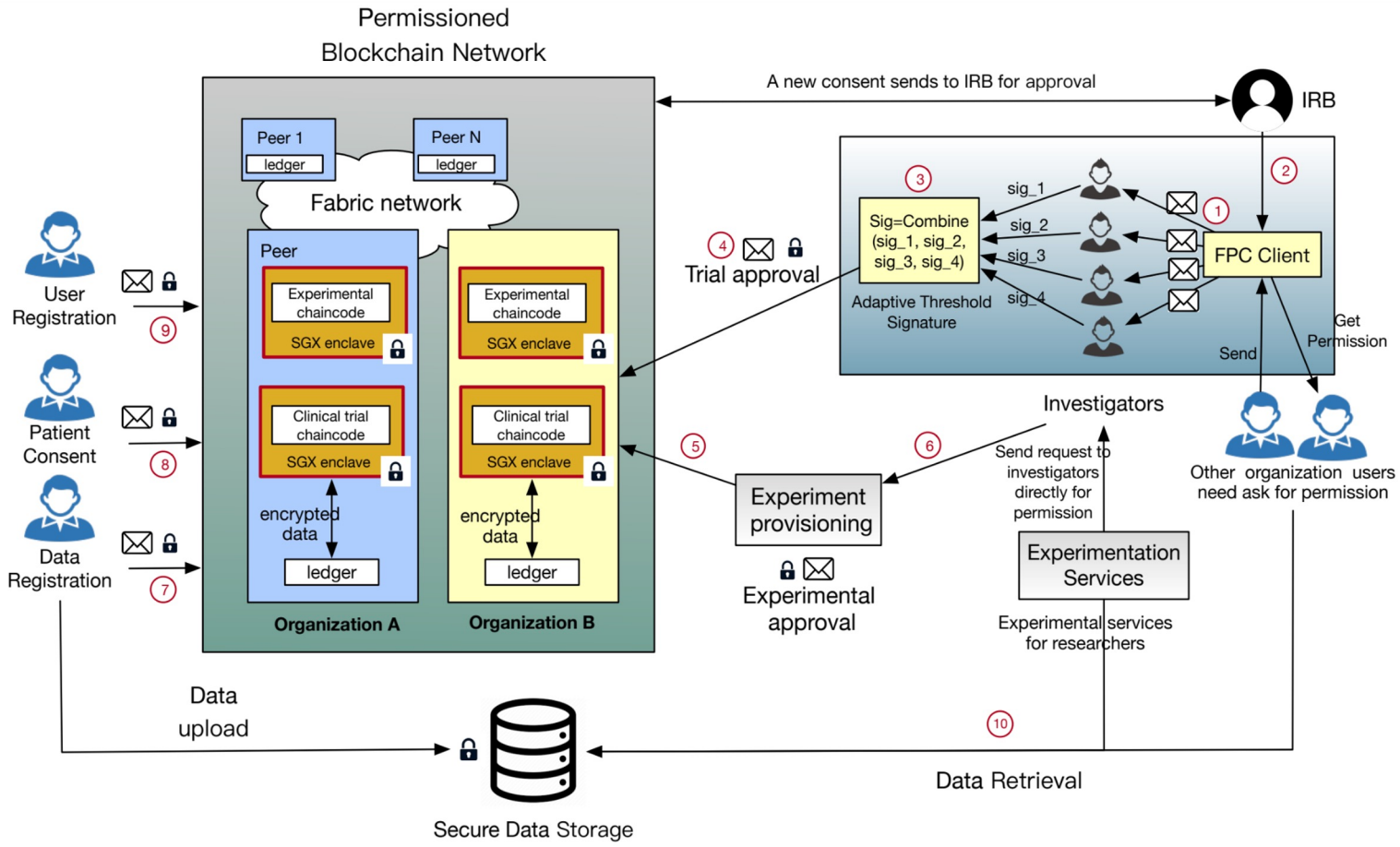


Softhread: From Research to Commercialization

- Overview: Softhread utilizes Chios™ for secure data management across IoT and healthcare.
- Product Portfolio: Includes Zero Trust Data Exchange and e-Consenting Tools, emphasizing privacy and security.
- Market Impact:
  - Addressed vital needs in data management, security, and interoperability across various industries including healthcare, energy, and more.
  - Enhanced ROI through innovations like zero-trust solutions and federated learning models.
- Competitive Edge and Partnerships: Partnerships with IBM, Intel, and NSF have positioned Softhread at the forefront of industry solutions.
  - Collaborations: With industry giants like IBM, Intel, and academic institutions to foster further innovation.
  - Awards and Recognition: Including Small Business Innovation Research awards and selections at notable forums like Hyperledger Global Forum.

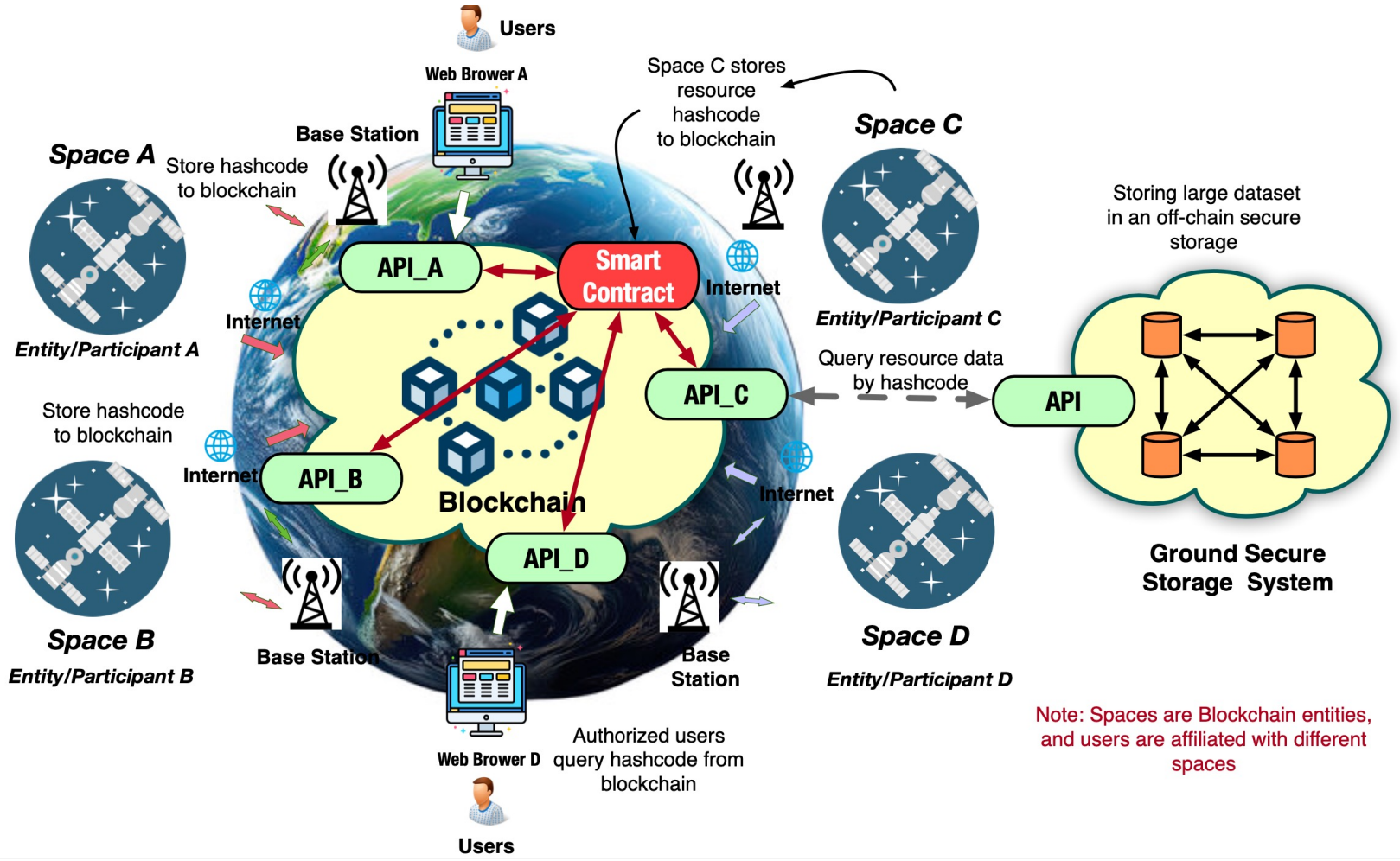
Impact and Success of Chios in Patient Consent

- 3 Maryland Innovation awards (TEDCO)
- Supported by: **SBIR 1 and SBIR 2**
- Case Studies: Highlight Chios in applications like end-of-life consent and medical data exchanges.
- Achievements: Showcases improvements in data integrity, security enhancements, and operational efficiencies.



NASA Year 1: Blockchain Distributed Ledger for Space Resource Access Control

- Leverage **blockchain** technology to enhance security in inter-satellite
- Pioneer a secured decentralized communication network
- Fortify blockchain applications in the space industry to withstand cyberattacks.
- Implement Off-chain storage for large datasets



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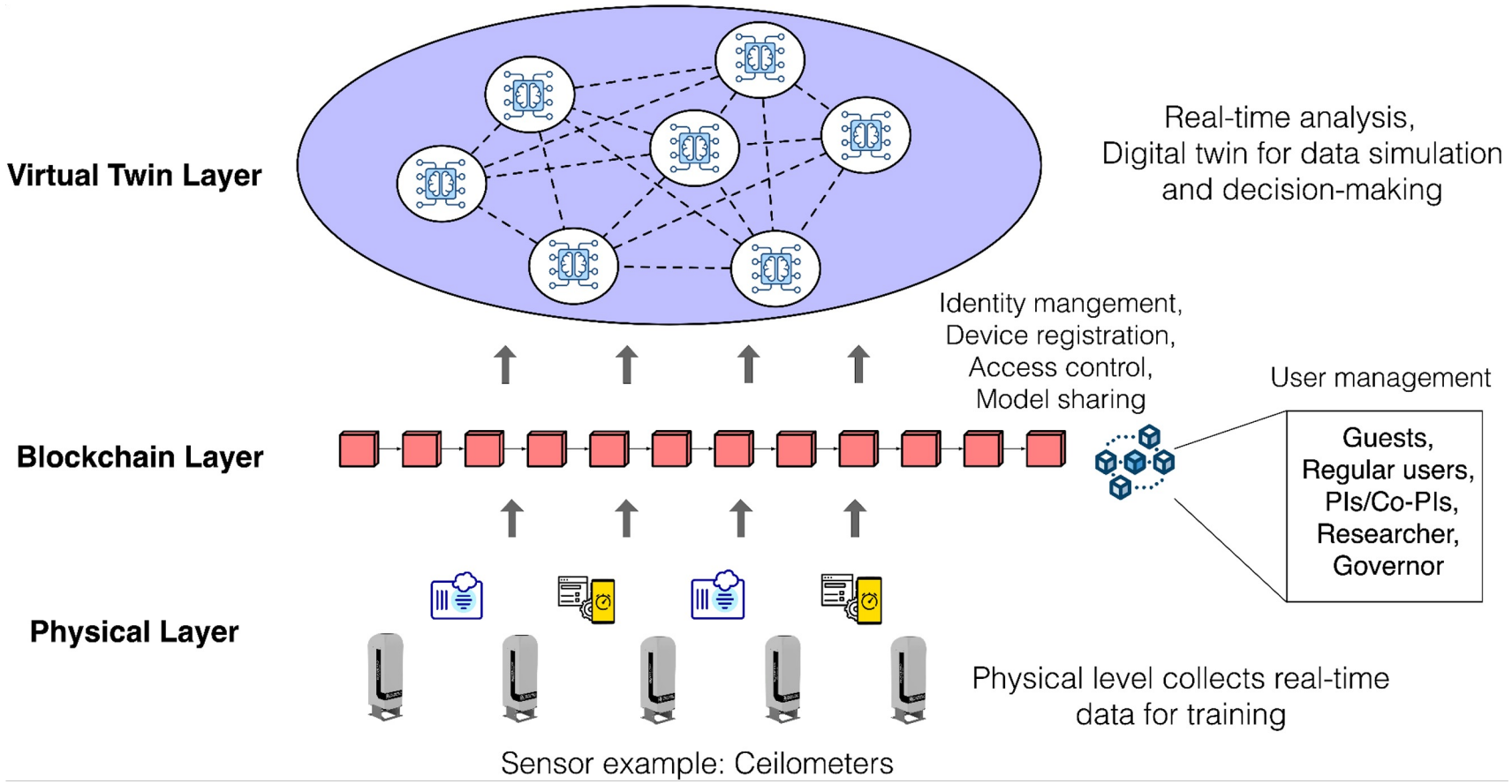
NASA Year 2: Blockchain Distributed Ledger for Space Resource Access Control （Digital Twins）

- Implement a blockchain network that empowers zero-trust cybersecurity measures for safeguarding data access and secure message exchange
- Develop a permissioned blockchain and Access Control to enhance security for device registration.
- Build a virtual Twin Layer for data simulation and real-time decision-making



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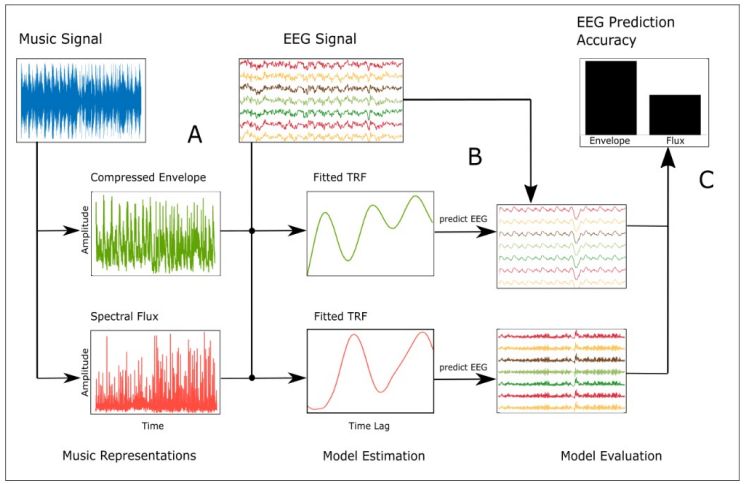
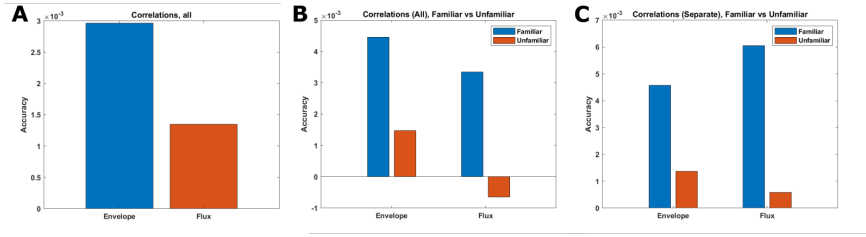
Neural Encoding of Music Familiarity

- Team: Ogihara (CS), Andrew Dykstra (BME), Brian Manolovitz (CS)
- Member: Legacy Research Institute
- Background: Up to 25% of patients with disorders of consciousness are estimated to have residual awareness
  - Command following (“imagine playing tennis”)
  - fMRI can provide neural evidence for residual awareness
- Goal: Determine whether familiar music is encoded more strongly than unfamiliar music
  - Ultimately, use findings to develop methods for treating neurodegenerative diseases

- Approach: Subjects listen to playlists of familiar and unfamiliar music
  - Unfamiliar music is given multiple times
  - Collect EEG during the listening and resting times
  - Develop individual models for classification

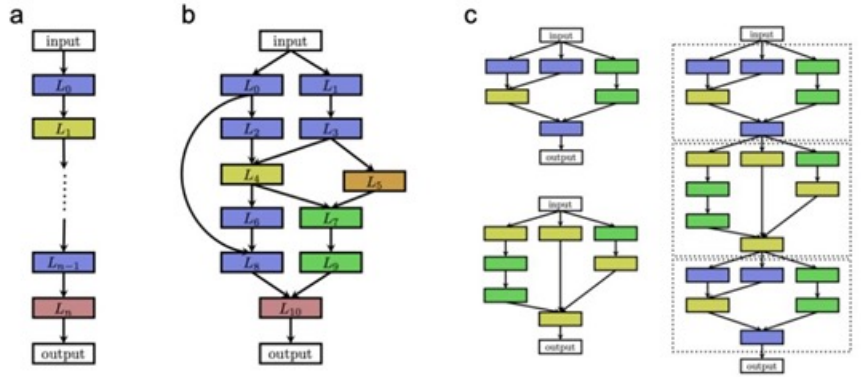




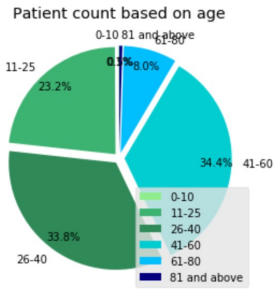
MIAMI IDSC LEGACY HEALTH

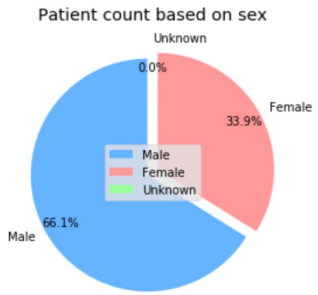
AI-based Risk Assessment for BZD Usage

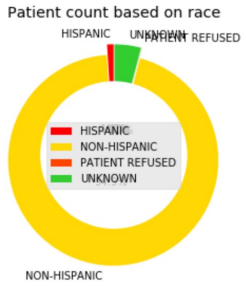
- Team: Yelena Yesha (CS), Phuong Nguyen (CS), Smriti Prathapan (IDSC)
- Member: The Rockefeller Institute at West Virginia University
- Goals:
  - Symptoms of BZD use, tapering, and discontinuation
  - Identify patient subgroups who are vulnerable to getting addicted
  - Risk assessment based on withdrawal symptoms
- Approach:
  - Neural Architecture Search (NAS) and evaluate and compare with Random Forest, XGBoost, Bayesian optimization neural architecture search algorithm
  - Predict risk of hospital visit for overdose started at 3 months before the first BZD prescription and continue to 12-mo follow up and or confirm BZD positive in lab tests.
  - Input variables: patient information, medications, hospital services, and lab tests (~34 factors).



- Results
  - Predict Substance use risk as a binary classification problem
  - BZD and/or combined with other substances (opioid, alcohol, cannabis, cocaine, nicotine, and other psychoactive substances)
  - Reasons to visit as a multi-class classification problem
  - Predicted prolonged or short-term addiction





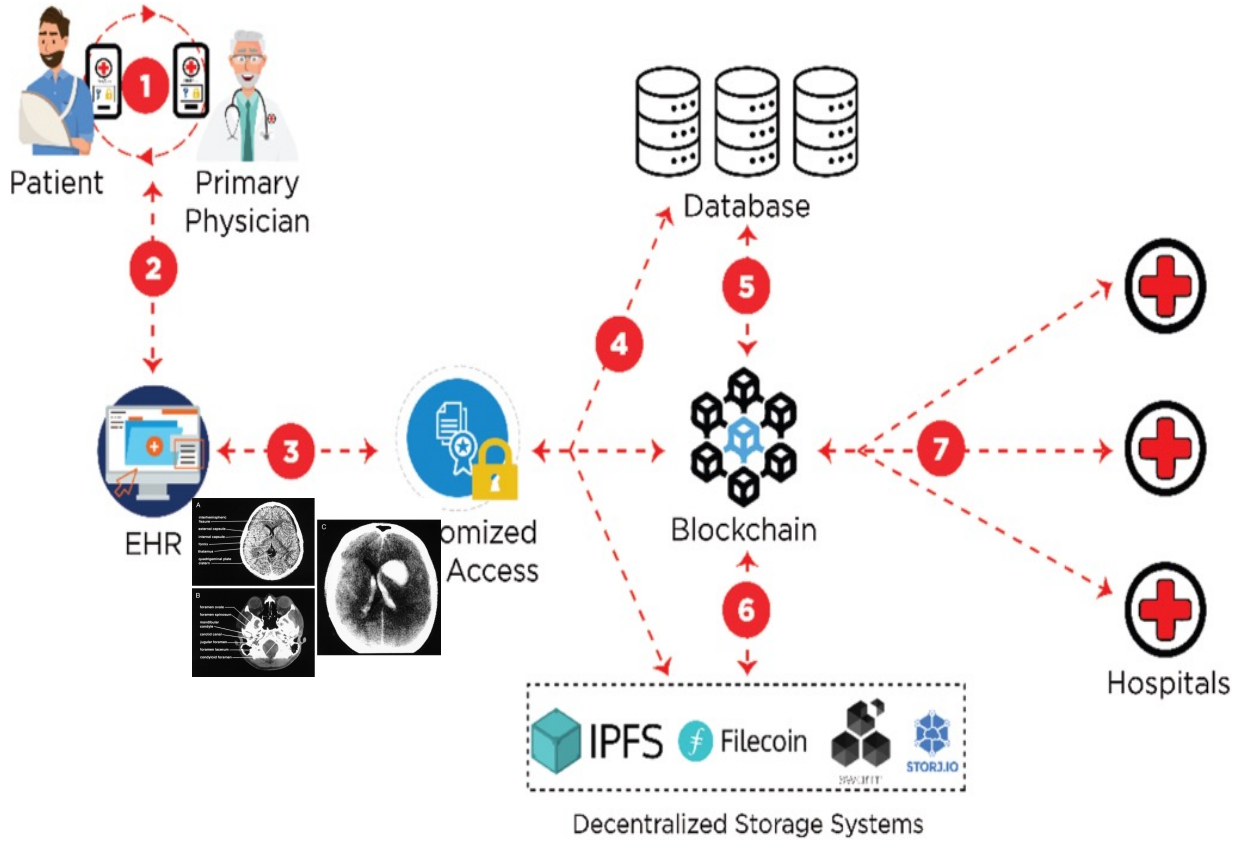


Machine Learning Model	Accuracy (%)	Area Under Curve (AUC)	PPV* Precision
AdaBoostM1	71.9	0.7	0.69
Logistic Regression	72.7	0.72	0.71
Feed Forward Neural Network	79.5	0.789	0.79
Random Forest (TP rate 0.95, FP rate 0.08)	95.9	0.97	0.96

MIAMI IDSC WVU Rockefeller Neuroscience Institute

Permissioned Blockchain for Efficient Image Sharing & Exchange

- Team: Yusen Wu (IDSC), Phuong Nguyen (CS), Yelena Yesha (CS), Mitsu Ogihara (CS)
- Member: Neurotargeting
- Advantages:
  - **Security and Privacy**: The inherent security features of blockchain can protect sensitive patient data.
  - **Interoperability**: A blockchain network can act as a standardized integrative platform, facilitating easier sharing and access
  - **Immutability**: After recording, data is recorded on a blockchain, making it tamper-proof.
  - **Traceability**: Every transaction on the blockchain can be traced, creating a clear audit trail and providing the provenance of medical images.
  - **Efficiency**: Blockchain can automate the sharing process through smart contracts, reducing administrative overhead.
  - **IPFS Storage**: Integrating with decentralized storage systems like IPFS (InterPlanetary File System) and Filecoin can further enhance the efficiency of storage and retrieval of large image files



NeuroTargeting

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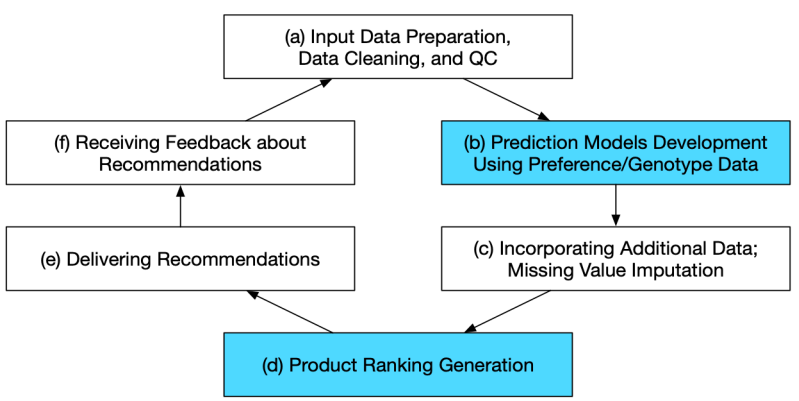
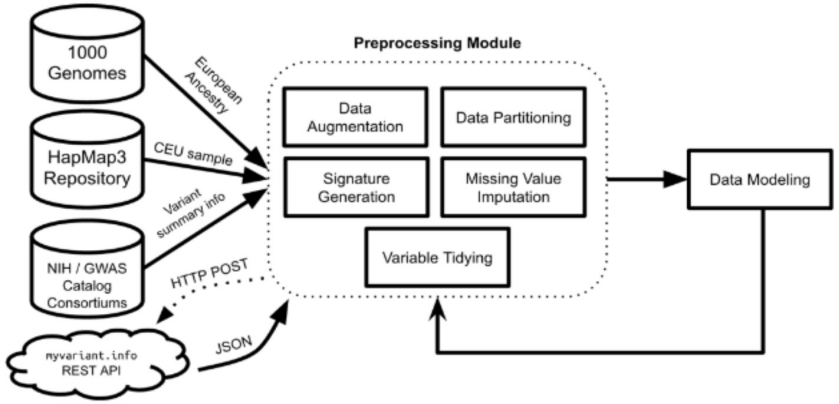
Genotype-aware Consumer Product Recommendation System

- Team: Vanessa Aguiar-Pulido (CS), Mitsu Ogihara (CS), Jerry Bonnell (IDSC)
- Member: GenRecSys / YE Ventures
- Goal: Develop
  - A recommender system for inferring the likelihood of matches between consumer products and individuals that possess genetic data
  - An AI-based approach to extract non-trivial relationships in highly dimensional data that will be used to inform the recommender
- Results:
  - Direct access to subject-level genotype data (e.g., GWAS case-control cohorts) is a lengthy, cumbersome process
  - Data often aggregated to eliminate the possibility for re-identification of subject
  - Crucial to collaborate with partners that are readily able to access genetic data
- It is possible to develop a learning-based method that features interpretability, high accuracy when retrieving, signatures in high-dimensional data, Patterns discovered can be incorporated to refine the recommender system





MIAMI IDSC YE VENTURES

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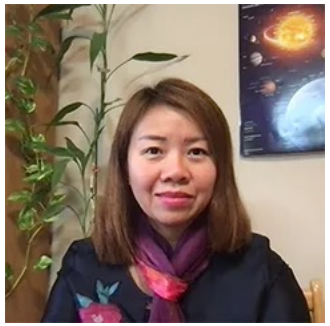

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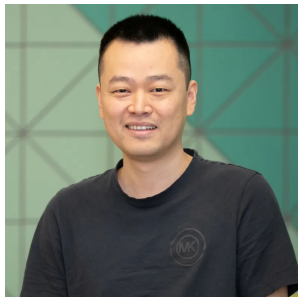

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