



www.utopiacompression.com



Leadership Statement

From the Research Desk to Integrated End-to-End Solutions: UtopiaCompression Corporation (UC) is a rapidly growing, cutting-edge technology company providing mission critical solutions to various US Government Agencies and industry leaders. UC's technologies and products focus on advancing state-of-the-art in the areas of cognitive computing, computational vision, UAS Sense- and Avoid (SAA), wireless communications and networking, and decision support systems. UC's portfolio of automated and intelligence-based technologies presents unique enablers for any value chain requiring intelligence-based processing, distillation and fusion of multi-modal data to empower actionable decision making.

To consistently achieve technological excellence and produce innovative products serving the needs of its clients, UC is committed to the following:

- ` Producing superior and innovative products with significant commercial potential and broad economic and societal benefits
- ` Delivering substantial return on client investments
- ` Developing the highest levels of expertise in computational intelligence
- ` Creating exceptional job opportunities and work environments to attract and retain technical and marketing talents

Core Competencies

Capitalizing on its distinguished researchers and engineers, UC brings together collective competencies and unique experiences to explore new technologies and create innovations in military and homeland security systems, as well as civil commercial markets. UC's core competencies include:

Intelligent Data/Image Processing and Computational Vision

- ` Pattern-driven multi-sensor visual data modeling and compression
- ` Panoramic imaging system
- ` Intelligent visual analytics for ship protection and port security
- ` Automated Target Recognition with incremental knowledge assimilation
- ` Affective computing

Intelligent Autonomous Systems

- ` Unmanned Aircraft Sense and Avoid Technology
- ` Collaborative task allocation and planning for unmanned systems

Wireless Ad Hoc and Sensor Networks

- ` Routing and topology management for tactical mobile ad hoc networks (MANETs)
- ` Tactical MANET routing optimization using social metrics
- ` Generative programming architecture for tactical gateway design
- ` Dynamic utility maximization for next generation satellite communication networks

Medical Technologies

- ` Wireless Body Area Physiologic Monitoring System for Assessment of Health Status of the First Responders and the Warfighters
- ` Decision-support systems for diagnosis and monitoring of a host of diseases and injuries (includes traumatic brain injury, burn injury diagnosis, hemorrhagic shock assessment)

Training Technologies

- ` Desktop and web-based intelligent technologies for military skill training
- ` Education data-mining algorithms to track skill decay to send timely reminders for refresher training
- ` Technology compatible with game-based front-end and numerous learning management systems.

UC's portfolio of automated and intelligence based products and solutions offer unique enablers for any value chain requiring creation, storage, processing, recognition, fusion, communication and/or distribution of data (still images, live combat video, 3D imaging, automated health status, etc.).

Products/Solutions include:

Intelligent Data/Image Processing and Computational Vision

Intelligent Pattern-Driven Image Compression and Transmission:



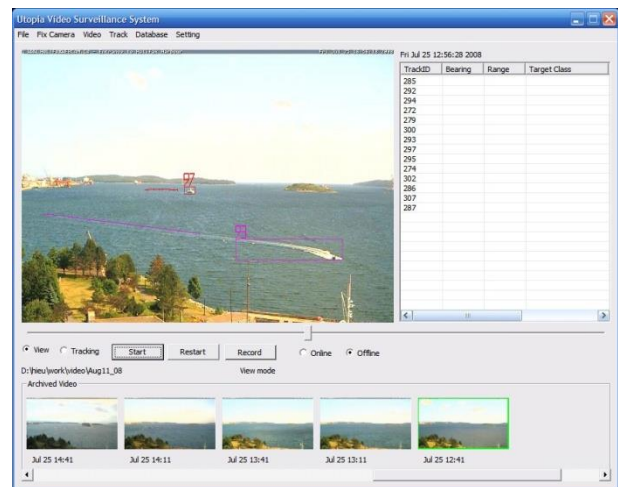
UC's suite of novel compression solutions addresses specific customer requirements. Included in this software solution suite are: pattern driven image/video compression, 3D surface modeling and compression, synthetic aperture radar de-speckling and compression, and adaptive class-based compression technology for weapon seekers. Our intelligent pattern-driven image encoding/decoding software solutions offers superior subjective quality and highly efficient compression performance compared with the state-of-the-art compression standards.

Video Analytics for Ship Protection Port Security and USV navigation:



The UC innovative maritime video analytic software and system solutions provide robust and effective enablers for maritime surveillance applications for ship protection, harbor security, and USV navigation. The system performs automatic detection, tracking and classification of surface targets and generates automatic alerts of possible threats to operator. It also provides tools for analysts to perform video-based forensic analysis and rapidly search and query a video database by content (query by activities, query by example).

The software enhances performance of traditional video security systems both in terms of enhanced accuracy and reduced manpower. The system can process multiple video feed and can be deployed in both stationary and mobile camera platforms (such as ones mounted on ship, boat or buoy).



High-Resolution Hemi-spherical Camera:

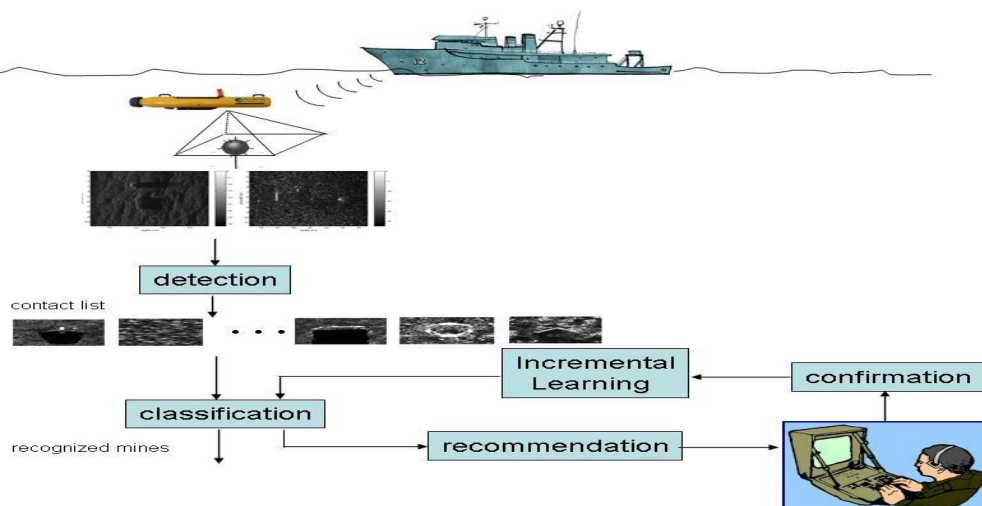


The UC-designed panoramic camera captures a hemispherical field of view (360x180o or 360x200o) with uniform high-resolution at video rate. The panoramic image has a single viewpoint and no distortion. Having a low form factor, weight and power consumption, the camera provides an exciting new opportunity for large area surveillance, as well as any application that requires imaging of large-field-of-view scenes. The camera operates in both indoor and outdoor environments.

Automatic Target Recognition:

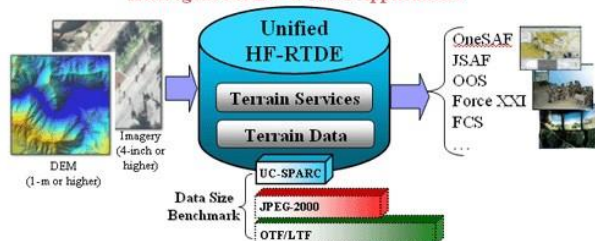
The existing ATR systems require retraining whenever the operational environment changes or new classes of targets needs to be added. Such offline retraining usually causes operational downtime. Sponsored by the US Navy, UC has developed an Incremental Knowledge Assimilation (IKAS) system as a novel automatic target recognition (ATR) software tool kit for detecting and classifying underwater mines from sonar images of the sea floor. Capitalizing on its unique capability of self-adapting to varying operational environments and online updating of new data, our IKAS system brings the following benefits:

- Eliminates the operational downtime while training
- Improves the efficiency and effectiveness of the mine hunting operational process
- Minimizes the human intervention and the associated cost while maintaining the same or better recognition performance



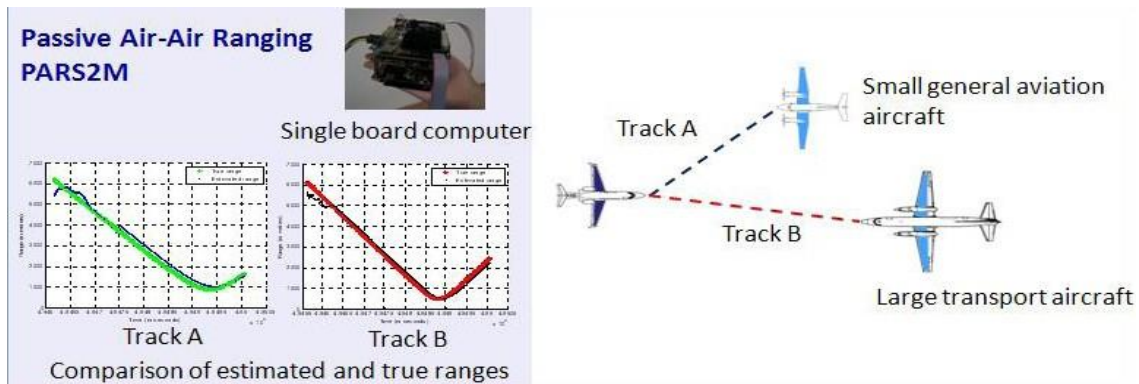
High-Fidelity Runtime Terrain Database Engine: Utilizing an innovative Scalable Pattern-driven Region-adaptive Compression (UC- SPARC), UC has developed a new generation High-Fidelity Runtime Terrain Database Engine (HF-RTDE). The UC-SPARC HF-RTDE software solution is capable of optimizing both real-world accuracy and simulation performance on platforms with limited disk, CPU, and memory resources. The software and services will provide compact storage of high-fidelity (4-inch or better) terrain geometry and imagery, >10x greater accuracy, and rapid runtime performance to support interoperable Live-Virtual-Constructive Modeling & Simulation applications as well as dynamic terrain updates and modifications. Specifically, our UC-SPARC HF-RTDE software libraries have been ported to a typical Android mobile device to demonstrate the applicability and potential transition to Force XXI Battle Command Brigade and Below (FBCB2) blue force tracker (BFT).

**A New Generation of Runtime Terrain Database Engine
(HF-RTDE) Capable of Providing
High-Fidelity Terrain Representations
&
Efficient Runtime Terrain Services
for
Heterogeneous L-V-C M&S Applications**

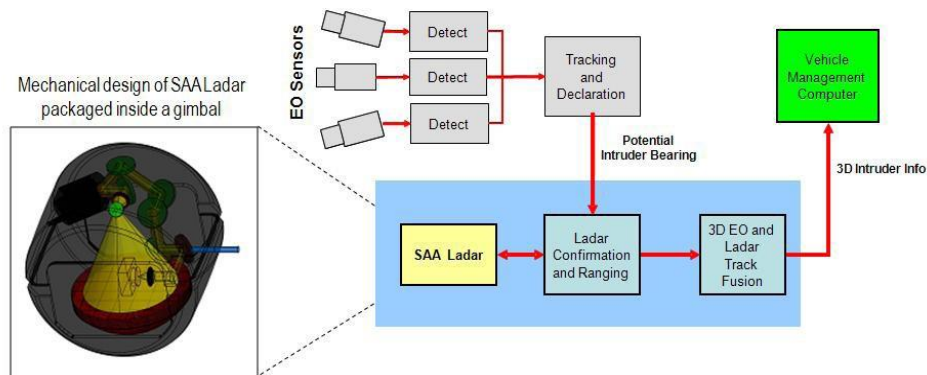


Solutions for Safe Operations of Unmanned Aircraft Systems

Passive sensor based end-to-end solution for air traffic detection and avoidance: UC offers embedded software solution to enable UAS to detect, track and avoid non-cooperative air traffic using passive electro-optical/infra-red sensors alone. The software leverages a number of recent algorithmic breakthroughs at UC such as novel image processing techniques to detect small targets characterized by low signal-to-noise ratios, patent pending approach to maneuverless passive range estimation and statistical decision theoretic approaches to collision prediction. The passive-only end-to-end solution is ideal for small to medium UAS with strict payload size, weight and power (SWAP) constraints.



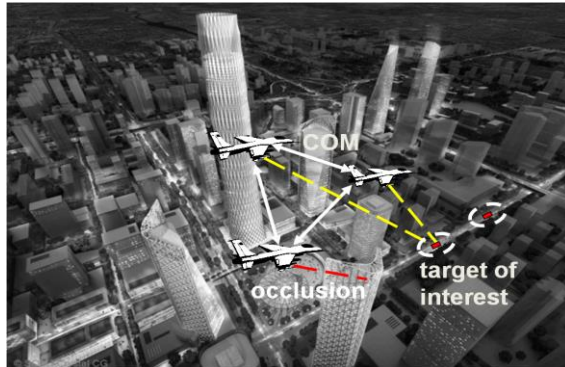
Sense and Avoid ladar: UC's sense and avoid ladar provides UAS the capability to autonomously detect, track and avoid other non-cooperative air traffic. The ladar operates in conjunction with passive EO/IR sensors to provide increased track accuracy and low false alarm rates. For low altitude operations, the SAA ladar can perform the dual function of obstacle and terrain detection. Size, weight and power requirements of the SAA ladar make it attractive for use on medium to large UAS.



Cloud detection and avoidance: UC offers an embedded automatic cloud detection and avoidance capability based on passive electro-optical sensors. UC's software automatically detects clouds in live EO video feed, computes the range from UAS to clouds, estimates the size of clouds and performs path planning to avoid clouds and keep the UAS in Visual Meteorological Conditions, all in real-time.



Collaborative task allocation and planning for unmanned systems: UC's collaborative path planning software offers an intelligent, efficient solution to coordinating multiple unmanned systems for target tracking applications in complex, dynamic scenarios, such as urban environment. The software learns motion profiles of targets and plans the paths of the unmanned systems to track targets as long as possible and can even identify anomalous target behavior. Extensive simulation results have demonstrated the effectiveness of UC's solution.

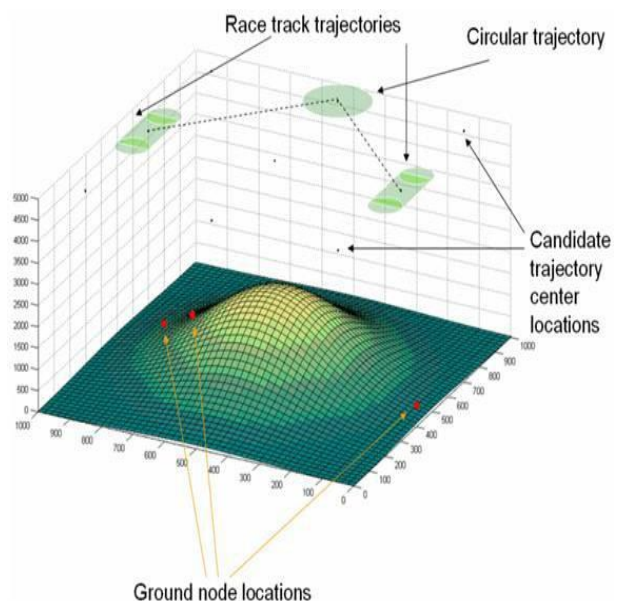
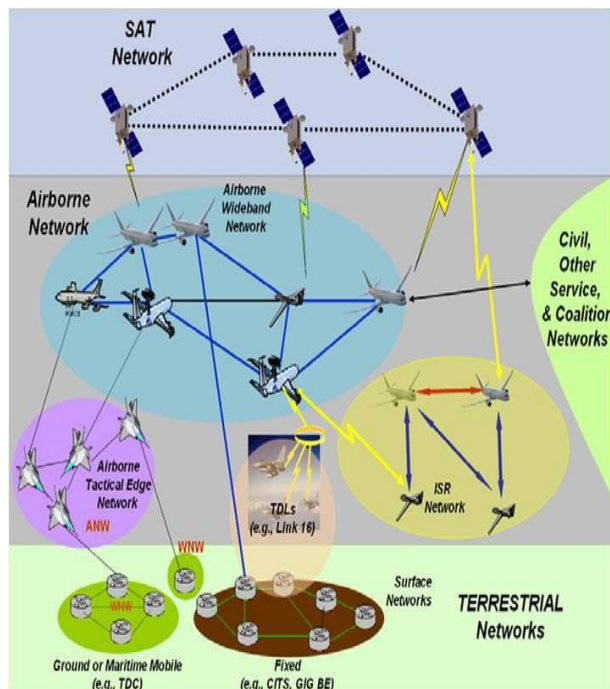


Wireless Ad Hoc and Sensor Networks

Routing, Topology Control and Mission Planning for Airborne Networks:

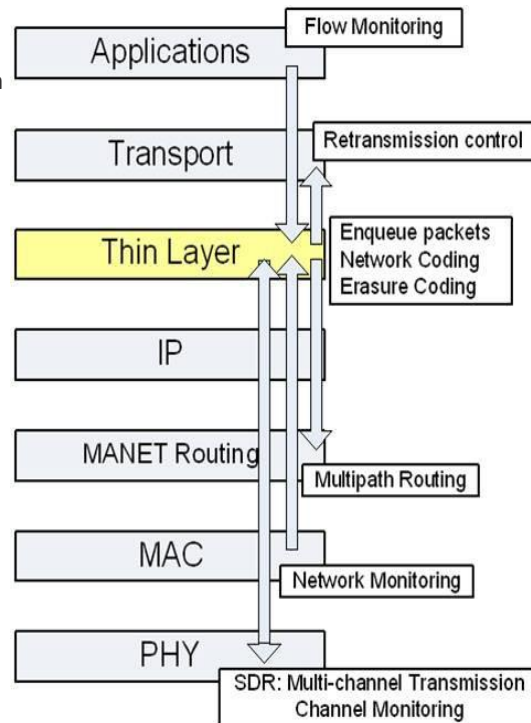
The Airborne Network (AN) is a critical component for realization of the DoD's vision of Network Centric Warfare and for achieving ubiquitous war-fighter connectivity through the Global Information Grid (GIG). UC's Mobility Aware Routing Protocol and Mobility Dissemination Protocol suite (MARP/MDP) performs significantly better than existing reactive and proactive Mobile Ad-Hoc Network protocols for military dynamic airborne network scenarios. The Mission Aware Topology Control (MAToC) protocol maximizes the Signal-to-Interference-plus-Noise Ratio (SINR) of high capacity directional links in the Airborne Network topology and reactively repairs links which have high packet-loss.

UC also offers a Mission Planning Toolbox (MPT) for Airborne Network deployment. MPT helps in planning airborne node trajectories such that their coverage provided to ground nodes is maximized while maintaining inter-airborne node connectivity. MPT can be used to design trajectories of close air support assets (Small UAS etc.) to maximize the radio contact opportunities between the close air support and the ground troops.



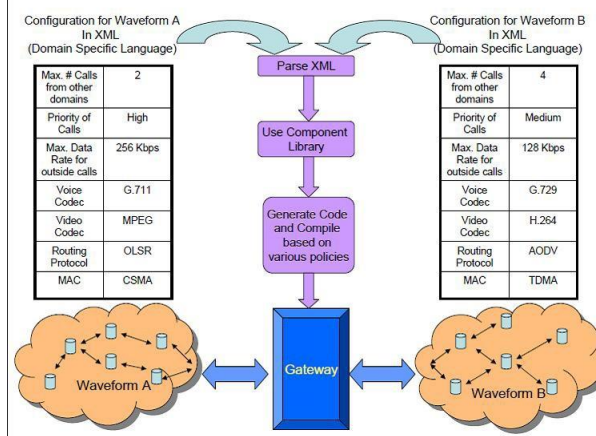
Thin Layer Approach to Increase Reliability in Ad Hoc Networks:

Radio communication in warfare faces several formidable challenges, e.g., high mobility, scalability, external interference, etc. These problems make network protocols unreliable. We solve these problems through exploitation of diversity mechanisms, multi-path routing, packet coding schemes, and multi-channel communication within the networking structure. To support the wide range of situations that occur in the battlefield, UC's "thin" software layer transparently interacts with other layers to leverage diversity mechanisms provided by each layer. Thin Layer turns on and off diversity mechanisms adapting to varying network environments and link conditions. Thin Layer technology has been successfully demonstrated to enhance the reliability of the Wideband Networking Waveform (WNW).



Agnostic Protocol Translation (APT):

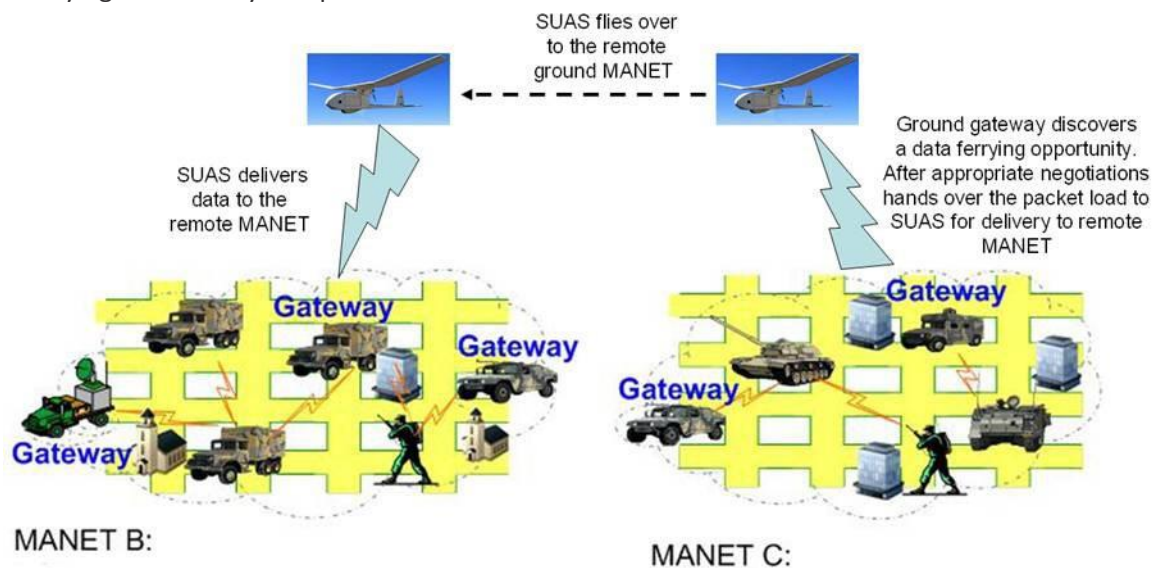
APT simplifies the tedious and immensely costly process involved in creating gateways between heterogeneous communication waveforms. A large number of gateways will be required by the Department of Defense (DoD) for integration of fielded legacy radios and legacy waveforms with next-generation radios and their corresponding IP waveforms currently under development.



The APT architecture includes a high-level Domain Specific Language (DSL) to describe waveform specifications, protocol behaviors, message structures and the gateway logic. A corresponding high level compiler validates and verifies the gateway logic against the desired inter-waveform interactions. The adoption of APT architecture by DoD would ensure radio and waveform interoperability at a significant reduction in cost.

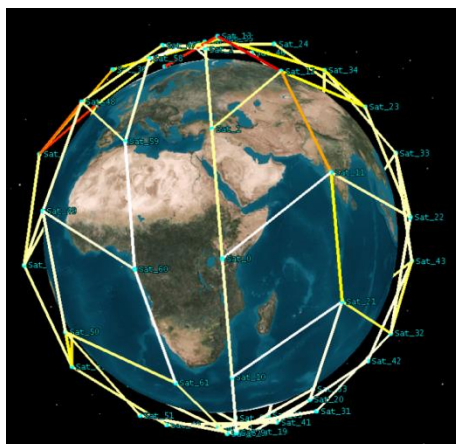
Mobility-Aware Disruption-Tolerant Opportunistic Routing (MADOR):

Effective autonomous routing and management for dynamic SUAS networks can result in reliable data delivery, lower congestion, higher communication capacity, energy conservation, and fault-tolerance capability. For those desirable network features, UtopiaCompression (UC) creates Mobility-Aware Disruption-Tolerant Opportunistic Routing (MADOR). We consider the communication and networking problem from the mission planning stage up to operational deployment. Mobility aware routing for SUAS is the basis for providing proactive and reactive solutions that use the knowledge of mission and mobility information of the aerial platforms. MADOR proactively determines the available mobility information, routing tables, packet storage, and connectivity while reducing energy usage due to overhead and excessive traffic usage. UC provides an integrated solution to both routing and disruption tolerant networking using the mobility knowledge about the network nodes by combining the overall routing and disruption tolerant networking suites under one unified umbrella protocol. Our research on energy-efficient routing ensured that the packet relaying load is distributed more evenly to the whole network so that some of the nodes' batteries are not depleted due to excessive information relaying before they complete the mission.



Dynamic Utility Maximization for Next-Generation Satellite Communication Networks:

UC has developed a centralized controller for next-generation satellite communication networks, which will greatly improve throughput, latency, and congestion performance relative to existing systems. The controller utilizes state-of-the-art network utility maximization (NUM) algorithms to optimize the network's utilization of its resources while satisfying various QoS metrics for different services. Multipath routing and periodic re-optimization ensure that peak performance is achieved and maintained with changing conditions. This technology benefits satellite network operators by allowing a greater number of simultaneous users. It benefits users by offering a range of services, from file transfers to video streaming, with higher data rates and lower latencies as compared to existing satellite networks.



Medical and Cognitive Assessment Technologies

Physiological Monitoring:

UC, in collaboration, with various physiological sensor platform developers is developing smart, end-to-end physiological monitoring systems. These systems boast wireless communication, long battery life, conformal form factors and built-in diagnostic intelligence. A dedicated miniature computing platform aggregates and fuses the sensor measurements by leveraging advanced artificial intelligence concepts to accurately infer the health status of the individual. The decision support software can handle any number or combination of relevant physiological sensors and can also be tuned to individual body and fitness traits for highly accurate health status reports.

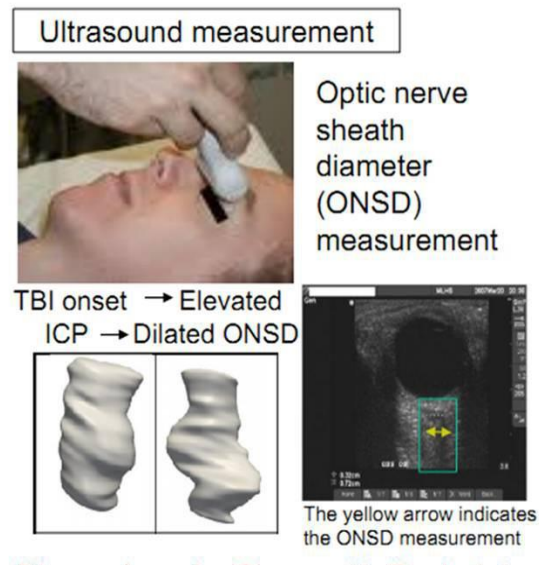
We are currently applying this technology for:

- Detection of cardiovascular events for fire-fighters
- Monitoring of blood-loss trauma of hemorrhagic shock
- Simultaneous monitoring of multiple casualties during medevac



Biomarkers for Traumatic Brain Injury Detection (TBI):

Portable ultrasound imaging offers considerable advantages over conventional modalities such as CT and MRI in terms of cost and risk of radiation. UC has developed novel TBI biomarkers based on ultrasound imaging of the optic nerve sheath (ONS). A portable tool based on these biomarkers can be used for point-of-injury diagnosis for concussion, and also to track healing over time. Novel image-processing and data analytics modules allow rapid visualization for diagnosis of mild TBI by medics and clinicians in the field. UC is collaborating with hardware vendors to bring low-cost, portable, high-resolution 3D-ultrasound probes for the military and civilian markets, where the technology holds promise to screen for concussion in contact sport players.

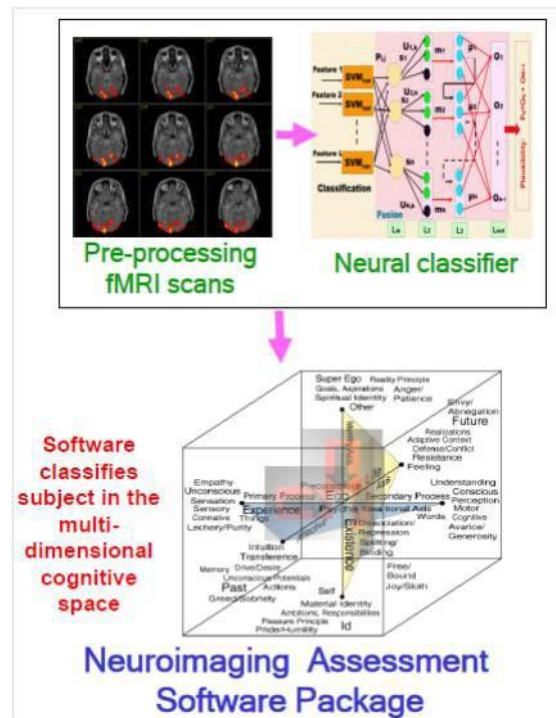


Burn Injury Diagnosis:

A suite of image registration and processing tools perform fusion of information collected from two non-contact imaging sensors for burn injury diagnosis. This work is fundamental in burn injury research where data fusion and machine learning classifiers are used to develop a decision support system to classify different burn types in a non-invasive, non-contact way. Utilizing complementary modalities such as optical coherence tomography (structural information) and pulse speckle imaging (functional information) improves detection of partial-thickness burns which are clinically challenging to diagnose. The technique when tested on porcine burn injury models provided an overall accuracy of 86% across all three burn types (superficial, partial-thickness and full-thickness).

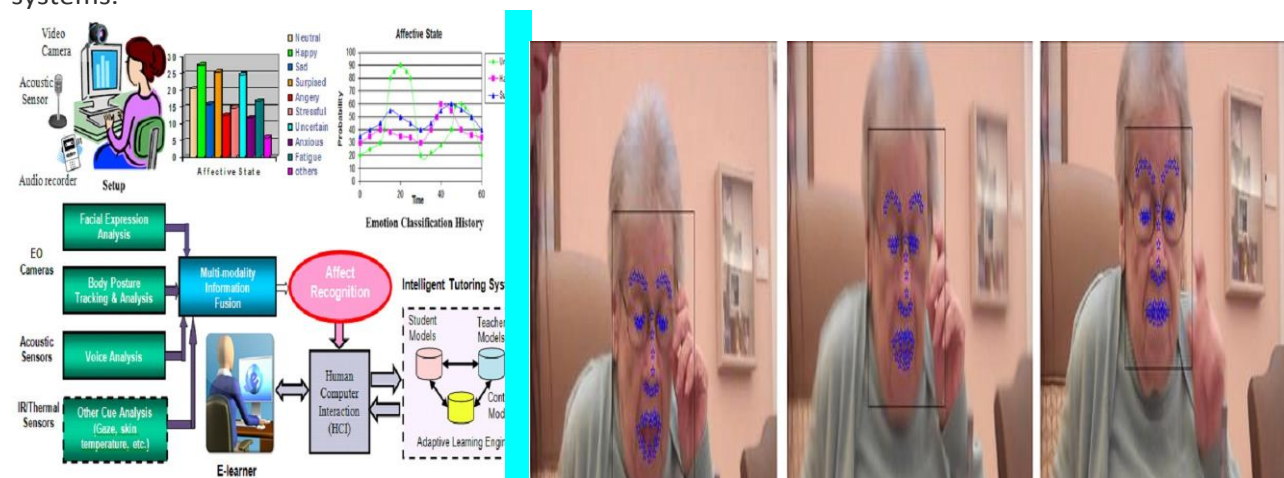
Cognitive Rehabilitation for PTSD and Mild TBI Subjects:

More than 10% of returning soldiers from Iraq and Afghanistan suffer from post-traumatic stress disorder (PTSD) and/or mild traumatic brain injury (mTBI). The symptoms of both PTSD and mTBI make it extremely difficult for veterans to join normal work force due to poor functioning of various cognitive skills such as memory loss and problems in spatio-temporal representation. At UC, we have developed an analysis tool using functional magnetic resonance imaging (fMRI) to map the cognitive functions and capabilities of warfighters. The analysis tool uses neural signatures captured from fMRI and applies machine learning techniques to automatically classify the affected brain regions which lead to poor functioning of certain cognitive functions. Based on this mapping, we can recommend a set of games that veterans can play to re-train their cognitive skills. We have also developed cognitive models based on adaptive control of thought-rational (ACT-R) architecture which can be loaded along with the gaming software on a cell phone for veterans to practice the recommended games at regular intervals. These models can track the performance of subjects and provide feedback.



SENSEI: Sensing Emotion and Engagement Non-invasively:

UC is developing a multi-modal emotion and engagement recognition system that can estimate human subjects' emotional and engagement level using a number of non-invasive external cues, including facial expression, body posture and voice intonation. UC's solution includes a set of innovative feature extraction and analysis modules for various sensory data and a novel probabilistic multi-modal information fusion framework that incorporates heterogeneous cues to aid in estimation of the human subject's emotional state efficiently and robustly. The major advantages of UC's SENSEI technology include: 1) Capable of sensing the subject's emotional state in real-time; 2) Integrating multiple cues in a systematic and probabilistic way; and 3) Flexible and extensible to add any additional modalities. UC is currently working with universities and adult-care centers to deploy this technology for the senior population in early stages of dementia. The system can tailor entertainment and recreation activities for the individual based on the measured engagement resulting in better quality of living for the individual and respite for the caregiver. The application can also be extended to develop personalized e-learning systems.



Training Technologies

Skill Mastery Assessment:

UC has developed a suite of tools to track acquisition and decay of cognitive, visuo-spatial and psychomotor skills as trainees learn to perform complex tasks requiring those skills. These tools combine insights gained through extensive human studies with the latest advances in neurocognitive theory and cutting-edge machine learning technology. These models use performance measures such as task speed and accuracy as well as other behavioral markers such as attention and emotion to dynamically and efficiently infer how the complex skills required for the given tasks are acquired. This, in turn, enables trainers to assess the depth of learning as well as to identify gaps in a trainee's knowledge during training. A smart tutor can utilize skill assessments to tailor training content adaptively during training for an individualized experience, accelerated learning and better retention. The tools also track skill decay due to non-use over prolonged periods, and are able to accurately predict onset of catastrophic forgetting. This suite of tools can be used with a diverse range of learning management systems (LMS), intelligent tutoring systems (ITS) and serious games for multiple operational and training settings.

Online cognitive tutors to provide automated feedback to soldiers

Online sessions

Smart phone apps

Customized training games

Cognitive tutoring software based on artificial intelligence concepts

The diagram shows a central 'Procedural' node connected to 'Goal' (G), 'Manual' (M), 'Imagined' (I), 'Visual' (V), 'Retrieval' (R), and 'Emotion' (E). Arrows indicate a flow from Goal to Manual, Manual to Imagined, Imagined to Visual, Visual to Emotion, Emotion to Retrieval, and Retrieval back to Goal. The 'Procedural' node is also connected to all other nodes.

Smart Tutor for Visual Learning Tasks:

Visual object recognition and rapid object-assessment tasks are an integral part of many military operational specializations and civilian professions such as surgery. UC has developed an intelligent tutoring system (ITS) for Visual Aircraft Recognition (VACR), a critical skill pertinent to air defense. Warfighters operating surface-to-air missile defense systems need to quickly recognize aircraft and identify friend from foe within a few seconds, while eliminating fratricide. UC's smart tutor features VACR mastery assessment that quickly and accurately identifies learner type as well as specific aircraft a trainee is having difficulty with. This assessment is used to dynamically modify training content, as well as pedagogic instructional strategy and feedback thus tailoring learning experience to each trainee's individual needs. UC's smart tutor reduces training time, fosters deeper learning and ultimately increases warfighter effectiveness while reducing costs.

Customers

UC is proud and privileged to serve the following organizations and agencies:

- ` US Air Force
- ` US Navy
- ` US Army
- ` Department of Homeland Security
- ` US Missile Defense Agency
- ` Department of Energy
- ` National Aeronautics and Space Administration
- ` National Institute of Standards and Technology
- ` National Science Foundation
- ` Defense Advanced Research Projects Agency

Partnerships

UC actively pursues and welcomes collaboration with government prime contractors, high-tech organizations with complementary solutions, and premier university research centers. Currently UC has, and is developing business relationships with a number of prime contractors, product vendors, service providers, and universities.

Company profile

UtopiaCompression Corporation (UC) was formed in Los Angeles, CA in 2002 to harness the scientific vision, innovation and entrepreneurial spirit of its founders. Within its first year of operation, UC's technology was recognized by the National Institute of Standards and Technology (NIST) as one of the nation's top emerging technologies. Since that time, UC has developed into a rapidly growing, cutting-edge technology company, focused on pushing the limits of the state-of-the-art in its core competencies. During its lifespan, the UC team has won numerous US Government awards and contracts providing innovative technologies and solutions. UC technologies for image compression, visual knowledge discovery, and sense-and-avoid are currently on the transition pathway to our DoD customers and US War fighters. Some of the company highlights include:

- ` Several U.S. Patents with several more pending.
- ` Best Company Award (PortTechLa)
- ` A team of World-Class Scientists/Engineers and highly qualified Business Professionals.
- ` A solid track-record of consistently exceptional performance with various government customers.
- ` Streamlined management processes developed to bring high-tech ideas from concept to transition-ready solutions.
- ` Well established partnership with prime contractors and academic collaborators.

Core Advantage

Computing and high tech systems are increasingly taking over the processes that control the conduct of modern society. They are used in such diverse areas as industry, finance, corporate world, health care, education, governmental services, the military, and the homeland security. The strongly human driven paradigm of computing that tightly relies on software developers monitoring, debugging, revising and updating software solutions is progressively becoming more expensive and will ultimately be untenable due to resource constraints and lag-time. UC's core competencies are directed at enabling automation of machine processes and data management in order to optimize the utility of computing tools both now and in the future.

The pressures of modern networked society demand a paradigm shift in our conception of computing. UC aims to work with customers to build systems that:

- ` Have capabilities to self-heal, grow and adapt themselves vis-à-vis the dynamically changing environment in which they are immersed.
- ` Continually learn the nuances of their environment and reason about the world in order to act proficiently with minimal human involvement.

Although the design and construction of self-healing adaptive systems is a very tall task, it is the framework and the vision UtopiaCompression considers worthy of pursuing. Cognitive computing (alternatively computational intelligence) has the potential and promise of delivering the above paradigm. As a small company, we take pride in being one of the early leaders in developing expertise in cognitive computing and heralding the new era of intelligent adaptive solutions and systems.

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