charles river analytics

Innovative solutions through intelligent systems®

Leadership Statement

Core Technologies for Synergistic Solutions

Vision
Be the most effective, customer-focused provider of innovative R&D solutions for increasingly complex and important human-systems challenges

Mission
- Develop innovative solutions to complex human-systems challenges in Unmanned Systems, Decision Support, Human Behavior, and Advanced Training Platforms…
- …by exploiting and extending our expertise in Information Fusion, Computational Intelligence, and Human-Computer Interaction…
- …and by excelling in activities across fundamental science and technology areas, responsive research and development services, and innovative deployed products, with a customer focus at all times.

**Cognitive Science and Engineering**
Formal and systematic methods for:

- Eliciting and encoding knowledge from domain experts
- Assessing human cognitive and perceptual processes

Modeling individual/group perception, reasoning, and behavior via:

- Agent-based modeling and simulation
- Social network analysis and modeling

Design methodologies for adaptable and adaptive human-system interface development and evaluation
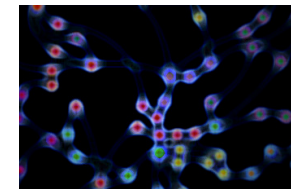
Hybrid Computational Intelligence
Unique mixing and matching of intelligent systems technologies for cost-effective solutions to complex and challenging problems including:

- Bayesian belief networks
- Case-based reasoning
- Data mining
- Expert systems
- Fuzzy logic
- Genetic algorithms
- Neural networks
- Argumentation systems

Our objective is to develop hybrid solutions through innovative architectures that integrate and synergize a broad spectrum of different technologies

Software Engineering and Development
- Iterative development practices that ensure transition from initial requirements analysis to system delivery and validation
- Testing, evaluation, and quality assurance
- Systems for local and distributed real-time operations
- Web-based applications for worldwide access and network-centric computing

Core Competencies

Customer Solutions by Service Division

Over 100 advanced prototype software applications exploiting a wide range of computational intelligence technologies

Our computational intelligence "toolbox" includes algorithms for:

Model-based and Agent-based Reasoning	Bayesian belief networks, fuzzy logic, rule-based expert systems, argumentation systems, hybrid inferencing, particle filtering, multi-hypothesis tracking, case-based reasoning
Biologically-Inspired Reasoning	Genetic/evolutionary algorithms, neural networks, ant-colony optimization, market-based negotiation algorithms
Machine Learning	Data mining, sequence pattern mining, link analysis, supervised classifier algorithms, decision trees, spatio-temporal clustering, latent semantic indexing, hidden Markov modeling, hierarchical hidden Markov modeling
2-D and 3-D, Vision-Based Analysis	Feature detection, multi-scale feature matching, model-based object recognition
Motion Analysis	Feature tracking, anomalous event detection, 3-D structure from motion

Powerful, in-house software tools to rapidly implement/apply these technologies

Wealth of domain expertise in developing user-focused solutions across a broad spectrum of applications

Our unique expertise and tools facilitate mixing and matching the best combination of technologies for use in rapid prototyping and building intelligent-systems solutions for the most complex and challenging problems.


Sensor Processing & Networking
- Automatic target recognition (ATR) and tracking
- Automated analysis of security and surveillance imagery
- Network and software trustworthiness optimization
- Vision-based autonomous navigation
- Image and video enhancement
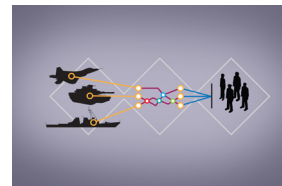
Decision Management
- Data mining, data/information fusion
  - Event detection and prediction
  - Situation analysis and threat assessment
  - Sensor/resource management
  - Course-of-action analysis
- Cyber security
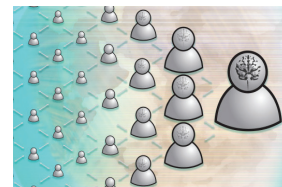
Socio-Cognitive Systems
- Sensor-based assessment of human physical and cognitive states
- Human behavior modeling for individuals, organizations, and societies
- Model-driven and model-backed assessment of complex situations
- Tactical intelligence management and collection

Human Effectiveness
- Intuitive interfaces and operator support tools for complex systems
- Work analysis, design prototyping, and human-in-the-loop evaluation
- Skill modeling, intelligent tutoring, game- and simulation-based training
- Information visualization

Innovative Deployed Products

AgentWorks™

An application to graphically design, build, and test complex intelligent systems

AgentWorks provides a robust set of modeling and analysis tools to support complex computational reasoning and an intuitive visual editor that lets you design and build intelligent systems without writing code. Its composite construction paradigm also allows you to incorporate legacy agent models and software systems to quickly field new systems to solve the next set of challenges.

AgentWorks is an extensible system. Anyone can contribute custom modules written in Java into its plug-in architecture as first-class tools that can be efficiently integrated with existing and developing computational modules.

BNet.Builder™

A desktop application for rapidly creating Belief Networks

BNet.Builder provides an intuitive graphical user interface (GUI) for generating lightweight and complex Bayesian belief models to support low-risk exploratory analyses, identification of system and data causality, and critical reasoning and decision-making tasks among other applications when faced with uncertain and interrelated networks of data. In addition, BNet.Builder's easy-to-learn GUI and modeling framework are ideal for quickly externalizing and representing expert knowledge, and for creating graphical models of cause and effect to see how incoming data affects results in real time; and clearly communicate how a system, network, or model works.

BNet.EngineKit™

A developer toolkit to embed Belief Networks into third-party applications

BNet.EngineKit is a developer toolkit enabling researchers, developers, and engineers to embed belief networks into custom software applications. Unique in its focus, BNet.EngineKit provides clear APIs with the right functionality to empower software developers who are not inference algorithm or Bayesian modeling specialists to rapidly integrate and support Bayesian networks without spending years learning about them and developing custom software code and libraries. With BNet.EngineKit's utilities, documents and sample code, you can implement application-tailored belief network capabilities in your projects easily and simply, and maximize ROI with your work quickly.

Connect™

A customizable, ontology-based network analysis toolkit

Connect is a network analysis tool designed to overcome the limitations of existing network analysis tools. Using Connect, analysts can build and analyze networks that are sensitive to missing, incomplete, or uncertain data. They can use Connect to explore networks using new types of analysis tools developed to solve some of the difficult problems that emerge with navigating and understanding large networks.

The Connect application embodies a user-centered design, is quick to integrate with existing data, and is easily learned by new users.

VisionKit®

A library of computer vision processing tools

Computer vision systems enable computers to automate repetitive visual tasks, freeing human experts to concentrate on higher-value activities.

VisionKit, Charles River Analytics' library of computer vision components, allows developers to rapidly prototype vision systems using our advanced technology. The components are written in C++, and are intended for real-time performance, while still offering a developer-friendly algorithm prototyping environment.

HumanSense™

A software and hardware platform for reasoning about human state

HumanSense provides a platform for prototyping solutions to collect, analyze, visualize, and reason about human physiological, neurological, and behavioral state. It combines commercially available off-the-shelf (COTS) hardware components (e.g., sensors, data transmitters, data servers), advanced analytic capabilities (e.g., model composition, probabilistic reasoning, network analysis), and HIPAA-compliant database servers that communicate through an open data exchange layer.

HumanSense solutions have been deployed to mobile devices, for web browsers, and as client-side applications for personal computers.

DRIVE™

A rapid human-computer interaction protyping tool to visualize multi-modal information

DRIVE's core architecture allows rapidly configurable "mappings" between the components of data models, the users' specific information needs, and visual elements and techniques for representing information and meta-information. Creating these mappings enables the display designer and developer to quickly generate and refine designs.

DRIVE supports the development of high-fidelity information visualizations and impressive visual effects while maintaining flexibility and supporting iterative design.

Figaro™

A free, open-source probabilistic programming language for probabilistic modeling

Figaro makes it possible to express probabilistic models using the power of programming languages, giving the user the expressive tools to create all sorts of models. Figaro comes with a number of built-in reasoning algorithms that can be applied automatically to new models. In addition, Figaro models are data structures in the Scala programming language, which is interoperable with Java and can be constructed, manipulated, and used directly within any Scala or Java program.

Figaro provides a rich library of constructs to build models and provides ways to extend this library to create your own model elements.

Customers

Partnering

Our customers include the following Government agencies:

Some of the Academic and Industry partners we've teamed up with are listed below:

US Army
Army Aeromed Research Lab (USAARL)

Army Geospatial Center (AGC)

Army Research Institute (ARI)

Army PEO Soldier

Army PEO STRI

Army Medical Research and Materiel Command (USAMRMC)

Army Natick Soldier RD&E Center (NSRFEC)

Research, Development and Engineering Command (RDECOM)

US Navy
Naval Air Systems Command (NAVAIR)

Naval Postgraduate School (NPS)

Naval Sea Systems Command (NAVSEA)

Office of Naval Research (ONR)

Space and Naval Warfare Systems Command (SPAWAR)

US Air Force
Aeronautical Systems Center (ASC)

Air Force Office of Scientific Research (AFOSR)

Air Force Research Labs (AFRL)

Air Force Life Cycle Management Center (AFLCMC)

Space and Missile Systems Center (SMC)

Other DoD
Defense Advanced Research Projects Agency (DARPA)

Combating Terrorism Technology Support Office (CTTSO)

Joint Special Operations Command (SOCOM)

Missile Defense Agency (MDA)

Office of the Secretary of Defense (OSD)

Other Federal Government
Office of the Director of National Intelligence (ODNI) Intelligence Advanced Research Projects Activity (IARPA)

Dept of Homeland Security (DHS)

National Aeronautics and Space Administration (NASA)

National Science Foundation (NSF)

Academic
Arizona State University
Boston University
Claremont Graduate University
Cornell University
Georgia Institute of Technology
Georgia Tech Research Institute
Harvard Medical School
Johns Hopkins
Massachusetts Institute of Technology
Ohio State University
Penn State University
University of Buffalo - SUNY
University of California at Berkeley
University of California at Irvine
University of Kentucky
Worcester Polytechnic Institute
Wright State University

Industry
5D Robotics, Inc.
Analytic Graphics, Inc. (AGI)
Appirio
BAE Systems
Booz Allen Hamilton
CACI Enterprise Solutions, Inc.
DiSTI Corps.
Draper Laboratory, Inc.
Lockheed Martin – Advanced Technology Laboratories
Lockheed Martin Corporation
MacAulay-Brown, Inc.
Metron Scientific Solutions
National Advanced Mobility Consortium (NAMC)
National Security Technologies, LLC
Passport Systems Inc.
PatchPlus Consulting Inc.
Qinetiq
RealTime Immersive
Roth Cognitive Engineering
SiCore Technologies
TORIS Technologies

Corporate Overview

Providing intelligent systems technology, software tools, and design/analysis services for government and private industry
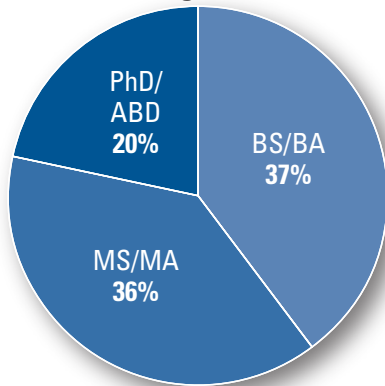
Applying innovative, cutting-edge, computational-intelligence technologies to difficult problems in:
- Sensor and image processing
- Situational awareness and decision-aiding
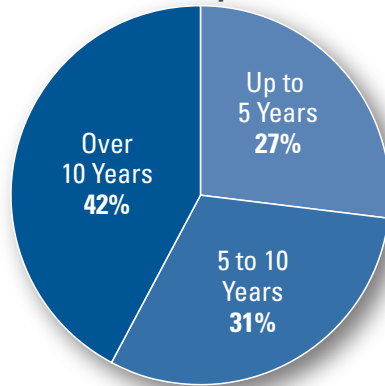- Human systems integration
- Cyber analytics

Integrating unique human capabilities with computational power for:
- Converting data into information
- Augmenting it with stored knowledge to create actionable intelligence
- Using it to respond quickly to complex and rapidly changing situations and environments
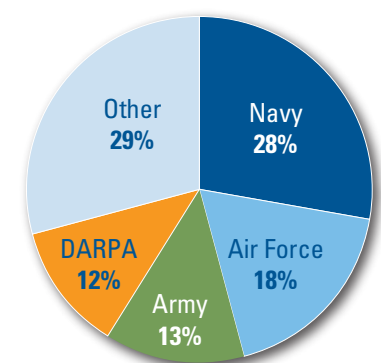
Corporate Background

Employee-owned Small Business headquartered in Cambridge, MA, since 1983
- 150+ employees and associates
- TS-cleared personnel and facility
- GSA Schedule for IT Services

Bridging the gap between thought leaders in academia and systems developers/integrators in DoD
- Long-term collaborative partner with world-class universities
- Strong participation in professional societies/panels
- Close relationships with several lead system integrators

FY14 Contract Revenue by Agency

Other 29%
Navy 28%
Air Force 18%
Army 13%
DARPA 12%

Research Staff Degrees

PhD/ABD 20%
BS/BA 37%
MS/MA 36%

Software Developers Years of Experience

Up to 5 Years 27%
5 to 10 Years 31%
Over 10 Years 42%

Revenue History

Revenue ($M) vs. years '84 through '15
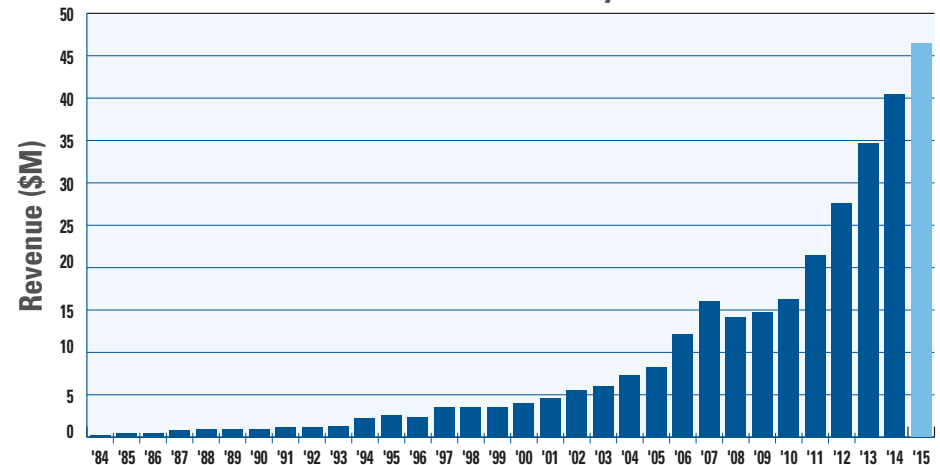
Management Team

MS. KAREN A. HARPER
President;
Principal Scientist

At Charles River Analytics, Karen provides strategic direction for both our Government Services and Commercial Solutions Divisions. Karen directs the research and development activities of our four technical divisions: Sensor Processing and Networking, Decision Management Systems, Socio-Cognitive Systems, and Human Effectiveness. She also leads our efforts in leveraging our significant IP portfolio to develop commercial solutions across government and private industry applications. In her role as Principal Scientist, Karen leads programs focused on autonomy development for unmanned systems, including real-time sensor processing enabling autonomous situation awareness and decision making, real-time control systems in maritime robotics applications, and human-centered remote supervisory command & control (C2) solutions. Karen's expertise also spans the simulation of human behavior, at both the individual and organizational levels, and the development of advanced human/computer interfaces (HCIs) for complex C2 systems. Karen is currently a member of the Small Business Technology Council Board and the New England Innovation Alliance. She holds a BEng degree in Mechanical Engineering from Memorial University of Newfoundland, Canada, and an MS degree in Aerospace and Mechanical Engineering from Boston University, where her research focused on robotics and control, specifically biologically-inspired robot locomotion.

MR. DONALD S. REYNOLDS
Vice President
Finance and Administration

Don directs the Finance and Administration division at Charles River, responsible for a broad range of functions including finance, contracts, human resources, information systems, security, and facilities. He has over twenty years of experience in senior management positions in the government contracting arena. Don's areas of expertise are budgeting and forecasting, financial reporting, contract administration, and project management. He received his BS in accounting from Kent State University and his MS in Finance from Boston University. He is a Certified Public Accountant, Certified Management Accountant, and Certified Financial Manager.

MR. SAMUEL MAHONEY
Vice President, Business
Processes and Systems;
Principal Scientist

Sam focuses on maximizing the value Charles River provides to customers while increasing efficiencies by providing consultation to internal organizations with strategic, operational, and tactical guidance on business processes and systems. In addition, Sam oversees Charles River's Proposal, Project, and Process Improvement Management Office (P3MO), which supports key infrastructure projects within the corporation. Sam's area of expertise is centered in Systems Engineering principles applied to advanced research and development of data centric intelligent systems. Since 2003, Sam has led research and development projects, with a particular emphasis on program management (e.g., scheduling, staffing, contract management) in recent years. Throughout his career, Sam has concentrated on modeling and simulation and business intelligence technologies in multiple domains including military intelligence and training technologies. In addition, Sam holds a strong research interest in emergent properties in complex systems and the design process to support change-resistant, evolvable organizations. He received his BS in Computer Science from Stonehill College.

DR. SCOTT NEAL REILLY
Vice President, Decision
Management Systems;
Principal Scientist

Scott leads the Decision Management Systems Division, which develops and applies a wide range of applied artificial intelligence (AI) techniques to help people make better decisions. These AI techniques include: planning and optimization; data mining; data fusion; machine learning; knowledge representation; and natural language processing. He is primarily interested in human-machine decision-making systems that help people understand the world and make better decisions. This has led him to work in areas such as real-time agent architectures, affective decision making, ensemble machine learning, social-behavior modeling, plan recognition, causal analysis, believable agents, sensitivity analysis, and mixed-initiative systems. Scott earned a BS in Computer Science from Duke University. He earned his MS and PhD in Computer Science from Carnegie Mellon University.

MR. RICHARD J. WRONSKI
Vice President, Sensor
Processing and Networking;
Principal Scientist

Rich leads the Sensor Processing and Networking Division, which develops software algorithms and integrated systems for the complex challenges of automatic target recognition, security and surveillance, vision-based navigation, image/video enhancement, and trustworthy sensor networking. Rich has successfully led programs for a wide range of both government and commercial customers, and has served as Director of Custom Products at American Science and Engineering, where he led development of innovative X-ray based detection systems geared to combating terrorism and trade fraud. Rich holds a BS in Electrical Engineering from Worcester Polytechnic Institute and an MBA in Entrepreneurship from Babson College.

MR. MIKE FARRY
Vice President
Socio-Cognitive Systems;
Principal Scientist

Mike leads the Socio-Cognitive Systems Division, which includes a portfolio of R&D and technology transition efforts that cover socio-cultural modeling, human performance assessment, human sensing, and the development of software to support intelligence analysis and influence operations. Mike works closely within the division to ensure the effective technical development of innovative ideas, from their earliest conceptual stages to their maturation as complete products tailored to user needs. He has directly served as a Principal Investigator on efforts in a variety of domains, including support for tactical intelligence collection, and sensor-based human performance assessment. Mike received his MEng degree from MIT in 2006, researching the construction of social networks from sensor network data with Prof. Samuel Madden, and a BS degree from MIT.

DR. RYAN KILGORE
Vice President
Human Effectiveness;
Principal Scientist

Ryan leads the Human Effectiveness Division, which combines expertise in user interface design, training, and software development to successfully integrate human operators with complex technologies. Ryan's research interests focus on cognitive work analysis and the design and evaluation of intuitive interfaces for supervisory control, decision support, and skill development. At the heart of Ryan's research is a deep passion for collaborating first-hand with operational personnel and end users to understand and address the challenges they face. He received a BS in Chemical Engineering from Worcester Polytechnic Institute and a PhD in Human Factors Engineering through the University of Toronto's Interactive Media Lab.

Core Advantage

Contact Information

Performance	Over 30 years of steady growth providing innovative, cost-effective solutions through intelligent systems R&D
Technical Discriminators	In-depth experience base in a wide range of state-of-the-art computational intelligence technologies allows us to mix and match the best combination of technologies for the most cost-effective solutions
	Unique, in-house software tools to facilitate rapid prototyping of intelligent software systems via user-friendly interfaces to various modular functions, features, and display options
	Proven track record of managing multi-disciplinary teams across a broad spectrum of application domains
	Over 100 Charles River projects have produced a wealth of advanced-technology prototype software (with TRL ratings from 3 to 9) that can facilitate the rapid integration of critical technology into operational systems
Reputation	Recognized as key science and technology (S&T) developers across the DoD
	Senior management participation in national-level, science-advisory panels
Credentials	Over 56% of professional staff hold advanced technical degrees
	Strong participation in professional societies and related technical publications
	Long-term collaborative partner with world-class universities
Other Discriminators	Employee-owned Small Business status under NAICS Code 541712 (Less than 500 Employees)
	TS-cleared personnel and facility

Charles River Analytics Inc.
625 Mount Auburn Street
Cambridge, MA 02138

Voice 617.491.3474

Fax 617.868.0780

Website www.cra.com

Karen A. Harper, x533
President
kharper@cra.com