The Vision for CISML

- Develop *interdisciplinary* theory and practice of intelligent systems and machine learning technologies
- Enable *cross-fertilization* of ideas from several individual disciplines
- Attract *increased external funding* involving multiple faculty
- Connect *industry with curricula and research*
- Help UTK reach its *Top 25 goal*, by cultivating our core competencies in intelligent systems and machine learning
- Attract more *highly qualified students*
- Integrate *curricular content* and emphasize interdisciplinary study
CISML Organization

Center for Intelligent Systems and Machine Learning (CISML)
Organizational and Management Chart

Approved as a formal UTK Center in October, 2010
CISML UTK Faculty – From 3 Colleges, 6 Depts.

College of Arts and Sciences
- Dr. Daniela Corbetta, Psychology
- Dr. Shih-Lung Shaw, Geography

College of Engineering:
- Dr. Itamar Arel, EECS
- Dr. Michael Berry, EECS
- Dr. Qing Cao, EECS
- Dr. J. Wes Hines, Nuclear Engineering
- Dr. Jeremy Holleman, EECS
- Dr. Bruce MacLennan, EECS
- Dr. Lynne Parker, EECS
- Dr. Hairong Qi, EECS
- Dr. Jindong Tan, MABE
- Dr. Xiaopeng Zhao, MABE

College of Business Administration
- Dr. Ham Bozdogan, Statistics, Operations, and Mgmt. Sci. (SOMS)
- Dr. Wenjun Zhou, SOMS
### CISML Nat’l Lab Affiliates – from 2 Divisions

#### Computer Science and Mathematics Division
- Dr. Jacob Barhen, Complex Systems

#### Computational Science and Engineering Division
- Dr. Brian Worley, CSE Director
- Dr. Vladimir Protopopescu, CSE Chief Scientist
- Dr. John Goodall, Cyberspace Sciences and Information Intelligence Research
- Dr. Thomas Potok, Computational Data Analytics
- Dr. Chad Steed, Computational Data Analytics
- Dr. Songhua Xu, Computational Data Analytics
Partnerships that provide…

- Access to undergrad and grad students for internships, employment
- Collaborative research with CISML
- Access to all public domain software developed, with opportunities for licensing
- Access to faculty and student research publications
- Recognition as CISML Industrial Affiliate
Opportunities are Numerous and Significant:
Many potential applications \(\rightarrow\) Many funding sponsors

Example applications:

- **Energy applications**
  - *E.g., Building energy prediction*

- **Environmental monitoring**
  - *E.g., prediction of volcanic eruptions*

- **Geographic Information Systems**
  - *E.g., people tracking*

- **Medical diagnosis**
  - *E.g., Breast cancer detection, diagnostic imaging, detection of cause of heart attack*

- **Text and data mining**
  - *E.g., Electronic discovery*

- **Cognitive computing and robotic learning**
  - *E.g., Using infant perceptual-motor learning*

- **Reliability and prognostics**
  - *E.g., in nuclear reactors, multi-robot systems*

- **Intelligent transportation systems**
  - *E.g., automatic detection of incidents, maximizing flow*
External Funding Opportunities

- **Important sponsors** with broad open BAAs relevant to CISML include AFOSR, ARO, DARPA, DOE, IARPA, NIH, NSF, ONR, etc.

- **Other Industries** CISML has engaged with the following:

  - Pilot Travel Centers
  - Computable Genomix
  - SAS
  - Luxottica
  - Voices Heard Media, Inc.
  - Capital One
  - Lockheed Martin
  - BOUNCEit!
  - Intel
  - jtv
  - iMi Associates
  - Document Solutions, Inc.
Building CISML Synergies from Existing Competencies

- CISML Affiliates have broad expertise in Intelligent Systems and Machine Learning:
  - Reinforcement learning, deep machine learning (Arel, Parker)
  - Text/data mining and knowledge discovery (Berry, Bozdogan, Goodall, Parker, Potok, Worley, Xu, Zhou)
  - Human infant perceptual and motor learning (Corbetta)
  - Cognitive learning (Arel, Corbetta)
  - Pattern recognition (Barhen, Berry, Hines, Parker, Qi, Steed)
  - Prognostics and diagnostics (Hines, Parker)
  - Embodied intelligence (Arel, Corbetta, MacLennan, Parker)
  - Collaborative/Cooperative/Distributed systems (Parker, Potok, Protopopescu, Qi)
  - Remote sensing (Barhen, Parker)
  - Sensor networks (Cao, Tan)
  - Biologically-inspired intelligence (Arel, MacLennan, Parker, Potok)
  - Biomedical applications (Zhao)
Established the Graduate Research Assistantship for Master Students (GRAMS) program in conjunction with ORNL and Science Alliance

- **US citizens only**
- **Two ORNL divisions participating**
- **Open to industry**
- **Three objectives:**
  - To create a vibrant pipeline of outstanding masters level students who will complete their degrees while working to further research in science and engineering,
  - To expose UT students to the large-scale challenge problems faced by ORNL, and
  - To help offset some of the financial costs required to complete a master degree at UT

Added four new Faculty Affiliates and one Lab Affiliate:

- Qing Cao
  - EECS
- Jeremy Holleman
  - EECS
- Jindong Tan
  - MABE
- Chad Steed
  - ORNL
- Xiaopeng Zhao
  - MABE
CISML Accomplishments since last review

- Three multi-investigator proposals funded and one still in review

  - The above efforts involve 9 of CISML’s 13 faculty affiliates and involve departments from all three colleges represented by CISML

- Established new collaboration with UTHSC which shows early funding promise – see Intel funding above

- Produced multiple student internships with existing industry affiliates
  - PhD Student Sudarshan Srinivasan with M-CAM in Charlottesville, VA
  - PhD Student Denise Koessler with Link Analytics in Knoxville, TN

[$4.8 million funded] [DARPA]  [$30,000 funded] [intel]  [$312,000 funded] [NSF]  [$727,000 in review] [NSF]
Support seed money research funds for CISML faculty to pursue preliminary investigations
  – *Funds will be competitive*
    • Require identification of specific funding opportunities to be pursued, expected publication venue(s), and expected benefit to CISML
  – *Funds will primarily support preliminary research*
  – *Faculty will be required to submit developed proposals through CISML*

Establish the Distinguished Speaker Seminar Series
  – *Fund up to two internationally recognized machine learning experts for seminar speaking engagements*

Collaborating with colleagues at College of Charleston and Davidson College on very large ($4 mil) NSF EXTREEMS-QED proposal
Expected Returns are Significant

- **Increased Funding:** CISML will enable UTK faculty to attract significant collaborative funding that otherwise would not be possible.

- **Innovative Research:** CISML will develop new research directions enabled by cross-fertilization of ideas, to achieve multi-disciplinary, collaborative synergies.

- **International Recognition:** CISML will be recognized as a national and international leader in intelligent systems and machine learning.

- **Higher Caliber Students:** UTK will be better able to recruit high-caliber undergraduate and graduate students and postdocs.
Welcome back to Knoxville and CISML!

Itamar Arel
Michael Berry
Hamparsum Bozdogan
Qing Cao
Daniela Corbetta
Wes Hines

Jeremy Holleman
Bruce MacLennan
Lynne Parker
Hairong Qi
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Jindong Tan
Wenjun Zhou