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Editor-in-Chief, IEEE Computational Intelligence Magazine
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COMPUTATIONAL INTELLIGENCE
Another name for Natural Language Processing.
Computational intelligence (CI) is a successor of artificial intelligence. As an alternative to Good Old-Fashioned AI, it rather relies on heuristic algorithms such as in Fuzzy systems, Neural networks and Evolutionary computation. In addition, computational intelligence also embraces techniques that use Swarm intelligence, Fractals and Chaos Theory, Artificial immune systems, Wavelets, etc.

Computational intelligence combines elements of learning, adaptation, evolution and fuzzy linguistic to create programs that are, in some sense, intelligent. Computational intelligence research does not reject statistical methods, but often gives a complementary view (as is the case with fuzzy systems). Artificial neural networks is a branch of computational intelligence that is closely related to machine learning.

Computational intelligence is further closely associated with soft computing, scruffy AI, connectionist systems and cybernetics.
A Quote from A Book

- “Advances in Computational Intelligence, Theory and Applications,” edited by Fei-Yue Wang and Derong Liu.
- **Computational Intelligence** is the study of adaptive mechanisms to enable or facilitate intelligent behaviors in *complex and changing environments*.
- **Computational Intelligence** is the computational part of the artificial intelligence.
The Origin

Many pioneering scientists, including Newton and Maxwell, were motivated by a quest to discover the art and order in creation— to know the mind of God through study of His creations. Nearly all inventions have a counterpart in or are an extension of nature.

- Thermonuclear explosions occur in the stars
- Pulse modulation occurs in the human nervous system
- Bats have sonar and dolphin pings serve as a subterranean telephone

- Nature/biology inspires invention
- Engineering uses science and mathematics to emulate and extend nature
- As the bird motivated air flight, so does human/biological intelligence motivate study of advanced computational paradigms.
Definition of CI

Any biologically, naturally, and linguistically motivated computational paradigms include, but not limited to,

- neural network,
- connectionist machine,
- fuzzy system,
- evolutionary computation,
- autonomous mental development,

and hybrid intelligent systems in which these paradigms are contained.

Coined by the IEEE Computational Intelligence Society

Credited to Jim Bezdek, University of West Florida
Common Characteristics

- Biologically motivated behavior such as learning, reasoning, or evolution (*in the sense of approximation*)
- Parallel, distributed information processing
- Mysterious power under real-world complications
- Lack of qualitative analysis
- Non-repeatable outcomes
- Stochastic nature

Is this a panacea for our modern-day problems?
CI vs. Intelligent Systems (IS)

- IS covers on all aspects of artificial intelligence, focusing on the development of the latest research into practical, fielded applications.
- CI, on the other hand, is a collective effort in emerging, fundamental computational paradigms.
CI vs. Artificial Intelligence (AI)

- CI depends upon numerical data supplied by manufacturers and does not rely on “knowledge.”
- AI, on the other hand, uses “knowledge tidbits” and these knowledge is derived from human expert.
- The knowledge or intelligence exhibited from CI is *self-emerging and spontaneous* as opposed to *man-made and artificial* from AI.
IEEE CIS

- Neural Network Council was created in 1990
- Transformed into Neural Network Society in 2001
- Name changed to Computational Intelligence Society in 2005
- Currently have 5,600+ members
- $6,000,000 in reserves
- Field of Interest: is the theory, design, application, and development of biologically and linguistically motivated computational paradigms emphasizing neural networks, connectionist systems, genetic algorithms, evolutionary programming, fuzzy systems, and hybrid intelligent systems in which these paradigms are contained.
Technical Activities

- Bioinformatics
- Evolutionary Computation
- Computational Finance
- Fuzzy Systems
- Intelligent Systems Applications
- Neural Networks
- Emergent Technologies
- Autonomous Mental Development
- Data Mining
- Computational Games
Applications Task Forces

- Aerospace applications
- Computational Finance and Economics
- Data Mining
- Automotive applications
- Software engineering
- Virtual reality
- Intelligent control and factory automation
- Speech and vision processing
- Telecommunications
- Business Intelligence
- Biometrics
- Intelligent measuring systems
- Homeland security
Publications

IEEE TRANSACTIONS ON NEURAL NETWORKS
Impact factor 3.726

IEEE TRANSACTIONS ON FUZZY SYSTEMS
Impact factor 3.624

IEEE TRANSACTIONS ON EVOLUTIONARY COMPUTATION
Impact factor 3.736

IEEE CONNECTIONS
The Newsletter of the IEEE Neural Networks Society

IEEE Computational Intelligence Magazine
Impact factor 2.535
New Journals beginning 2009

- IEEE Transactions on Computational Intelligence and AI in Games
  (EiC: Simon Lucas, University of Essex, UK)

- IEEE Transactions on Autonomous Mental Development
  (EiC: Zhengyou Zhang, Microsoft Research, Inc., USA)
Co-Sponsor Publications

- IEEE Transactions on Bioinformatics and Computational Biology
- IEEE Transactions on NanoBioscience
- IEEE Transactions on Nanotechnology
- IEEE Systems Journal
The search process of a PSO algorithm should be a process consisted of both contraction and expansion so that it could have the ability to escape from local minima, and eventually find good enough solutions.
CIM- 2006

February 2006
**Evolving the World**
- Evolutionary Game
- Evolvable Hardware
- Evolutionary Multiobjective Optimization

August 2006
**Autonomous Mental Development**
- Cognitive Robotics
- Reasoning Theory
- Social Development

May 2006
**Image/Video Applications**
- Content Image Based Retrieval
- Self-Organizing Tree and Forest

November 2006
**Evolutionary Paradigm**
- Foraging Theory
- Ant Colony Optimization
- Artificial Immune System
February 2007
Type-II Fuzzy Set and Systems
- Fuzzy Controller
- Fuzzy Clustering
- Fuzzy Logic History

May 2007
CI-Based Biometrics Applications
- Fingerprinting
- Odor Source Localization
- Speaker Identification

August 2007
High-Level Cognitive Behaviors
- Reasoning
- Language
- Intuition and Creativity
- Consciousness
- Cognitive Robotics

November 2007
Hybrid Paradigm
- Fuzzy Ants
- Computing with Words
- Immune System for Stochastic Optimization
February 2008
In Memory of Lawrence J. Fogel
- Intelligent Agents
- Social Intelligence
- Evolving ANNs
- Artificial Creatures

August 2008
Fuzzy Intelligence
- Machine Intelligence
- Evolving Intelligence
- Biomimicry and Fuzzy Modeling
- Hypernetworks

May 2008
CI-Based Cyber Security Applications
- Intrusion Detection
- Privacy-Preserving Data Mining
- Symmetric/Block Ciphers

November 2008
Computational Finance and Economics
- Power Market
- Economic Game
- Portfolio Management
February 2009
Educational Issues in Computational Intelligence
- Interdisciplinary Course
- Teaching Natural Computation

May 2009
Emerging Neural-Network Models
- Support Vector Machines
- Adaptive Dynamic Programming

August 2009
Real-World Applications in EMO
- Portfolio Management
- A System Approach in EMO
- Closed-Loop Optimization

November 2009
Brain-Machine Interface
- Driving Cognition
- Biosignal Processing
Conferences

*International Joint Conference on Neural Networks (IJCNN)*
*International Conference on Fuzzy Systems (FUZZ-IEEE)*
*Congress on Evolutionary Computation (CEC)*
*International Symposium on Computational Intelligence in Bioinformatics and Computational Biology*
*International Conference on Granular Computing*
*International Conference on Developmental Learning*
*International Symposium on Computational Intelligence for Measurement Systems and Applications*
*International Conference on Computational Intelligence for Homeland Security and Personal Safety*
IEEE World Congress on Computational Intelligence

- 1994, Orlando, Florida
- 1998, Anchorage, Alaska
- 2002, Honolulu, Hawaii
- 2006, Vancouver, Canada
- 2008, Hong Kong, China
- **2010, Barcelona, Spain**

*Deadline for Paper Submissions: January 31, 2010*
IEEE World Congress on Computational Intelligence
Sheraton Vancouver Wall Centre Hotel,
Vancouver, BC, Canada
July 16-21, 2006

Welcome to the WCCI 2006 website

WCCI 2006 has moved to
JULY 16-21, 2006

NEW! Please sign our Guest Book to receive up-to-date information about WCCI 2006 over e-mails.

On behalf of the Operating Committee, I would like to welcome you to the venue of the 2006 IEEE World Congress on Computational Intelligence, Sheraton Vancouver Wall Centre in Vancouver, British Columbia, Canada. Inherited from its successful history in 1994-Orlando, 1998-Anchorage and 2002-Honolulu, WCCI 2006 is the largest technical forum in the Computational Intelligence community. Sponsored by the IEEE Computational Intelligence Society (formerly the IEEE Neural Networks Society), WCCI 2006 will provide a venue to foster technical exchanges, renew everlasting friendship, and establish
Welcome Message

On behalf of the Organizing Committee, I would like to invite you to participate in the 2008 IEEE World Congress on Computational Intelligence (WCCI 2008) to be held at the Hong Kong Convention and Exhibition Centre during June 1-6, 2008. WCCI 2008 will be the fifth milestone in this series with a glorious history from WCCI 1994 in Orlando, WCCI 1998 in Anchorage, WCCI 2002 in Honolulu, to WCCI 2006 in Vancouver. Sponsored by the IEEE Computational Intelligence Society, co-sponsored by the International Neural Network Society, Evolutionary Programming Society and the Institution of Engineering and Technology, and comosed of the International Joint Conference on Neural Networks (IJCNN), IEEE International Conference on Fuzzy Systems (FUZZ-IEEE) and IEEE Congress on Evolutionary Computation (CEC), WCCI 2008 will be the largest technical event on computational intelligence in the world with the biggest impact. WCCI 2008 will provide a stimulating forum for thousands of scientists, engineers, educators and students from all over the world to disseminate their new research findings and exchange information on emerging areas of research in the fields. WCCI 2008 will also create a pleasant environment for the participants to meet old friends and make new friends who share similar research interests. Please be assured that WCCI 2008 will be very memorable in your lifetime.

You are welcome to contact me if you have any comments or suggestions to make WCCI 2008 more exciting. Meanwhile, I and other organizers will work hard to ensure the success of WCCI 2008.

I look forward to meeting you all at WCCI 2008!
Welcome

The 2010 IEEE World Congress on Computational Intelligence (IEEE WCCI 2010) is the largest technical event in the field of computational intelligence. It will host three conferences: the 2010 International Joint Conference on Neural Networks (IJCNN 2010), the 2010 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE 2010), and the 2010 IEEE Congress on Evolutionary Computation (IEEE CEC 2010). IEEE WCCI 2010 will be held in Barcelona, a Mediterranean city located in a privileged position on the northeastern coast of Spain. Barcelona combines history, art, architecture, and charm within a pleasant and efficient urban environment where meet old friends, and make new ones. The congress will provide a stimulating forum for scientists, engineers, educators, and students from all over the world to discuss and present their research findings on computational intelligence.

We look forward to seeing you in Barcelona
Awards

- IEEE Frank Rosenblatt TFA Award
- CIS Neural Network/Fuzzy Systems/Evolutionary Computation Pioneer Award
- CIS Neural Network/Fuzzy Systems/Evolutionary Computation Outstanding Transactions Paper Award
- CIS Outstanding Chapter Award
- CIS Outstanding Ph.D. Dissertation Award
- CIS Student Travel Grant to attend IJCNN/FUZZ-IEEE/CEC Conferences

- Outstanding Computational Intelligence Early Career Award
- Outstanding Computational Intelligence Organization Award
Expand \((a + b)^n\)
3. Find $x$. 

Here it is
Introducing Myself...

- Ph.D. from the University of Notre Dame
- Project manager at the USAF Research Lab
- Professor at the Oklahoma State University
- Fellow of IEEE
- Vice President for the Technical Activities, IEEE Computational Intelligence Society, 2004-’05
- President, IEEE Computational Intelligence Society, 2010-’11
- Founding editor-in-chief, IEEE Computational Intelligence Magazine
- *General chair, 2003 IEEE International Symposium on Intelligent Control*, Houston, TX; *2006 IEEE World Congress on Computational Intelligence*, Vancouver, Canada
- Graduated nine Ph.D. and fifteen M.S. graduate students since 1997
- Published 2 books, 14 book chapters, 73 peer-reviewed journal articles, and 120 peer-reviewed conference papers
- Received 2000 outstanding young faculty and 2004 outstanding faculty awards from Halliburton Foundation; 2009 Regents Distinguished Research Award
Introduce yourself…

Name, Affiliation, Research Focus,
Your expectation from this short course
and anything else you would like to share