

Current Trends in Machine Learning for Signal Processing (MLSP)

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First, a very brief history...

- Started existence as the Technical Committee on *Neural Networks for Signal Processing* (NNSP) in 1990
- First NNSP Workshop September 1991, in Princeton, NJ
- First TC Chair, Fred B. H. Juang
- Yearly workshops since 1991

Yearly workshops since 1991

Workshops on Neural Network for Signal Processing

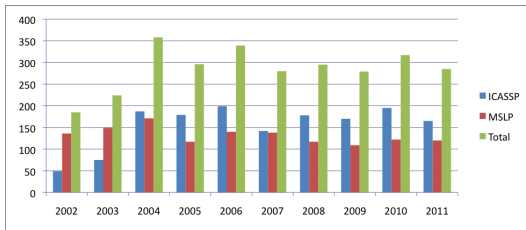
- NNSP 1991, September 30–Oct. 2, Nassau Inn, Princeton, New Jersey, USA
- NNSP 1992, August 31–September 2, Hotel Marienlyst, Helsingor, Denmark
- NNSP 1993, September 6–9, Linthicum, Maryland, USA
- NNSP 1994, September 6–8, Proto Hydra Resort Hotel, Ermioni, Greece
- NNSP 1995, August 31–September 2, Royal Sonesta Hotel, Cambridge, Boston, USA
- NNSP 1996, September 4–6, Keihanna, Seika, Kyoto, Japan
- NNSP 1997, September 24–26, Amelia Island Plantation, Florida, USA
- NNSP 1998, August 31–September 2, Newton Institute, Cambridge, England
- NNSP 1999, August 23–25, Madison, Wisconsin, USA
- NNSP 2000, December 11–13, Sydney, Australia
- NNSP 2001, September 10–12, Falmouth, USA
- NNSP 2002, September 4–6, 2002, Martigny, Valais, Switzerland
- NNSP 2003, September 17–19, 2003, Toulouse, France

Workshops on Machine Learning for Signal Processing

- MLSP 2004, September 29–October 1, 2004, São Luis, Brazil
- MLSP 2005, September 28–30 2005, Mystic, USA
- MLSP 2006, September 6–8, 2006, Maynooth, Ireland
- MLSP 2007, August 27–29, 2007, Thessaloniki, Greece
- MLSP 2008, October 16–19, 2008, Cancún, Mexico
- MLSP 2009, September 2–4, 2009, Grenoble, France
- MLSP 2010, August 29–September 1, 2010, Kittila, Finland
- MLSP 2011, September 18–21, 2011, Beijing, China

From NNSP to MLSP

- “Neural Network for Signal Processing” was deemed to be too narrow a scope by many
- Working with the IEEE SPS President at the time, Fred Mintzer, the TC approved the name: [Machine Learning for Signal Processing](#) which became the TC’s new name after approval by the BoG



Submissions to ICASSP in MLSP
and the MLSP Workshop since 2002

MLSP: What is the scope?

- The bridge between **machine learning** and **signal processing**
- *Learning* is the key aspect
- *Signal processing* defines the main applications of interest and the constraints
- Attractive solutions for traditional signal processing applications such as pattern recognition, speech, audio, and video processing
- Primary candidates for emerging applications such as BCI, multimodal data fusion and processing, behavior and emotion recognition, and learning in environments such as social networks

- Applications of machine learning
- Bayesian learning; Bayesian signal processing
- Cognitive information processing
- Graphical and kernel methods
- Independent component analysis
- Information-theoretic learning
- Learning theory and algorithms
- Neural network learning
- Pattern recognition and classification
- Bounds on performance
- Sequential learning; sequential decision methods
- Source separation

- Methods
 - Sparsity-aware learning
 - Learning in kernel spaces
 - Semi-supervised learning
 - Distributed learning
 - Subspace and manifold learning
 - Semi-blind data analysis, learning
- Besides learning, *integration* of approaches has been a key emphasis, making MLSP a natural home for
 - brain-computer interface
 - behavior and emotion recognition
 - multimodal data fusion and processing
 - multiple/joint data analysis
 - learning in environments such as social networks

Cognitive information processing represents a major paradigm shift in learning

A dynamic system is called *cognitive* if it exhibits all four cognitive properties:

- **Perception-action cycle**, which produces information gain about the environment, obtained from one cycle to the next
- **Memory**, which predicts the consequences of action on/in the environment
- **Attention**, which is responsible for the allocation of available resources
- Finally, **intelligence** provides the basis for decision-making whereby intelligence choices are made in the face of environmental uncertainties