

# MACHINE INTELLIGENCE

## DESCRIPTION

Research in the area of Machine Intelligence aims at developing and studying computational and mathematical models, algorithms, theories, and paradigms for analyzing, understanding, and modeling data, or more generally, reasoning about them. Key methodologies span across different interdisciplinary fields, such as artificial intelligence, symbolic computation, machine learning, signal and image processing, computer vision, and computer graphics. In more detail, in artificial intelligence topics of interest include knowledge representation and reasoning, intelligent agents and multi-agent systems, theorem proving and model building, as well as search methodologies, with emphasis on discrete space search. In machine learning main methods and approaches relate to graphical models, statistical learning and kernel theories, and multiclassifier methods for classification and clustering. In multi-dimensional signal processing the studied techniques regard advanced filtering, feature extraction and segmentation methods, multiresolution and sparse signal representations, time(space)/scale methods, including wavelets, compressive sensing, large scale image characterization and retrieval tools, related to both optical and multimodal images. Computer vision mainly exploits geometric and probabilistic approaches for 3D reconstruction, object recognition, dynamic scene analysis and understanding. Computer graphics relates geometric/physically-based theories for object modeling, shape analysis and visualization.

## LABORATORIES

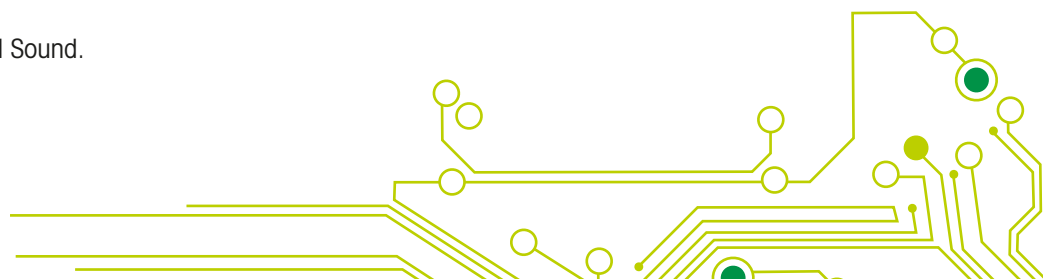
**ARlette:** Automated reasoning - artificial intelligence, symbolic computation, computational logic.

**K.Re.Art.I:** Representing knowledge using Artificial Intelligence.

**VIPS:** Vision Image Processing and Sound.

## PROJECTS (2012-2016)

- DSurf: scalable Computational method for 3D printing surface (PRIN 2015). The project aims at developing advanced Computer Graphics technologies for digital manufacturing. The task of the unit in Verona is related to the measurement and characterization of surface appearance and geometrical properties.
- Scan4Reco Horizon 2020 REFLECTIVE-7-2014, Grant Agreement No: 665091 Advanced 3D modeling for accessing and understanding European cultural assets. The project aims at developing methods for multimodal scanning of artworks and modelling of materials ageing.
- H2020 european project under the Innovative Training Networks H2020-MSCA-ITN-2015 call "Time-lapse understanding of the static and human scene and its lighting" (SceneUnderLight), (EU project 676455)
- COST, European Concerted Research Action "Rich-model toolkit: an infrastructure for reliable computer systems" (IC0901) 10/2009 - 10/2013. <http://richmodels.epfl.ch/>. The rich model toolkit initiative explores directions and techniques for making automated reasoning (including analysis and synthesis) applicable to a wider range of problems, as well as making them easier to use by researchers, software developers, hardware designers, and information system users and developers.
- 2013 PRIN Security Horizons. This project aims at developing a rigorous methodology and a language-based framework that will provide formal methods to support software engineers when they design, implement and maintain secure systems.



## SELECTED PUBLICATIONS (2012-2016)

- Segalin, C., Perina, A., Cristani, M., & Vinciarelli, A. (2016). The pictures we like are our image: continuous mapping of favorite pictures into self-assessed and attributed personality traits. *IEEE Transactions on Affective Computing*.
- Garro, V., Giachetti, A., Scale space graph representation and kernel matching for non rigid and textured 3D shape retrieval. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 38(6): 1258-1271 (2016).
- M. Bicego, P. Lovato. A bioinformatics approach to 2D shape classification. *Computer Vision and Image Understanding*, vol. 145, pp. 59-69, (2016) P. Lovato, M. Bicego, C. Segalin, A. Perina, N. Sebe, M. Cristani. "Faved!" biometrics: tell me which image you like and I'll tell you who you are", *IEEE Transactions on Information Forensics & Security*, vol. 9(3), pp. 364-374, (2014)
- A. Daducci et al. Quantitative Comparison of Reconstruction Methods for Intra-Voxel Fiber Recovery From Diffusion MRI. *IEEE Trans. Med. Imaging* 33(2): 384-399 (2014).
- Perina A1, Cristani M, Castellani U, Murino V, Jojic N. Free Energy Score Spaces: Using Generative Information in Discriminative Classifiers. *IEEE Trans Pattern Anal Mach Intell*. 2012 Jul;34(7):1249-62. doi: 10.1109/TPAMI.2011.241.
- M. Zucchelli, L. Brusini, C. A. Mendez, A. Daducci, C. Granziera, G. Menegaz What lies beneath? *Diffusion EAP-based study of brain tissue microstructure*, *Medical Image Analysis*, 32(2016) 145-156, <http://dx.doi.org/10.1016/j.media.2016.03.008>
- P. Lovato, M. Bicego, M. Kesa, N. Jojic, V. Murino, A. Perina. Traveling on discrete embeddings of gene expression, *Artificial Intelligence in Medicine*, vol. 70, pp. 1-11, (2016)
- F. Cicalese, E. Sany Laber, A. Medeiros Saettler. Diagnosis determination: decision trees optimizing simultaneously worst and expected testing cost. *ICML 2014*: 414-422
- M.P. Bonacina, D.A. Plaisted. Semantically-guided goal-sensitive reasoning: model representation. *Journal of Automated Reasoning*, 56(2):113-141, February 2016; DOI: 10.1007/s10817-015-9334-4
- A. Farinelli, A. Rogers, N.R. Jennings. Agent-based decentralised coordination for sensor networks using the max-sum algorithm, *Journal of Autonomous Agents and Multi-Agent Systems*, Volume 28(3), May 2014: pp. 337-380, Springer, DOI 10.1007/s10458-013-9225-1
- D.D. Bloisi, F. Previtali, A. Pennisi, D. Nardi, M. Fiorini, "Enhancing Automatic Maritime Surveillance Systems With Visual Information", In *IEEE Transactions on Intelligent Transportation Systems*, vol. PP, no. 99, pp. 1-10, 2016.
- M. Cristani, E. Karafilis, L. Viganò. Tableau systems for reasoning about risk, *Journal of Ambient Intelligence and Humanized Computing* 5 (2), 215-247, 2014.

## PEOPLE (2017)



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