IAPR TC 3
Neural Networks and Computational Intelligence

Final Report July 2016 – June 2018

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2 Manifesto

While keeping its traditional aims and topics of interest, starting from Jan 2017 the TC3 has a new Manifesto which focuses more on novel, off-the-beaten-track approaches. The Manifesto goes as follows:

"Mainstream science is about publishing what everyone else is publishing with very small changes. You'd better at least start off that way if

you want to get tenure," the sociologist Rodney Stark said. But "big ideas don't come to those who avoid risk", as John Bohannon added. The area of artificial neural networks and machine learning makes no exception to these ends. Mainstream topics, originally stemming from exciting breakthroughs (the "big ideas") that gradually become trends and end-up being mostly over-beaten publishing tracks, have characterized the scientific literature throughout the whole history of this research field. Based on these premises, IAPR-TC3 promotes real novel research developments in the areas of neural networks and learning machines that (1) are rooted in (or, aimed at) pattern recognition, and that, above all, (2) do not follow in the footsteps of nowadays established trends."

3 Activities in the last 24 months

1. July 17-23, 2016: Endorsement of the **International Computer Vision Summer School** (ICVSS 2016), Sicily, Italy.

2. September 28-30, 2016: Organization of the **7th IAPR TC3 Workshop on Artificial Neural Networks in Pattern Recognition** (ANNPR 2016), Ulm, Germany. **Proceedings** are published by Springer, ISBN 978-3-319-46181-6 (Editors: Schwenker, F., Abbas, H.M., El Gayar, N., Trentin, E.), 11844 chapter downloads to date.

3. 2016-2018: Complete editorial process of the *Neural Processing Letters* **Special Issue on "Off the mainstream: advances in neural networks and machine learning for pattern recognition"** (as a follow up of ANNPR 2016, including selected papers plus novel papers in response to an open CFP). Available online, expected publication date: Fall 2018.

4. May 14-17, 2018: TC3-endorsed **International Conference on Pattern Recognition and Artificial Intelligence** (ICPRAI 2018), Concordia University, Montral, Canada.

5. September 2017- September 2018: Organization of the **8th IAPR TC3 Workshop on Artificial Neural Networks in Pattern Recognition** (ANNPR 2018), DIISN, Siena, Italy. **Proceedings** to be published by Springer (Editors: Pancioni, L., Schwenker, F., Trentin, E.).

3.1 Website updates

A **brand-new website** was created in 2017: `http://iapr-tc3.diism.unisi.it/`. It includes the Manifesto, the news, the contact infos, and the history of TC3. Besides, it provides the community with the following material.

3.1.1 Educational Information and Tutorials

New and/or updated material includes:

- Deep Learning: Talks and Tutorials by Yoshua Bengio
- Where to Learn Deep Learning Courses, Tutorials, Software
- Probabilistic Graphical Models course by Sargur N. Srihari
- Tutorial: Neural Nets and Pattern Recognition Using MATLAB by O. C. Celebi

3.1.2 Research directions and application areas

New and/or updated research directions and application areas include:

(1) Deep learning. This has become a quite popular variant of neural networks typically possessing multiple representation layers, with higher-levels representing more abstract concepts. Deep learning is related to cognitive computing and has shown successes in applications involving sets of Big Data.

(2) Recurrent nets for sequences of patterns and structures. Juergen Schmidhuber's page on Recurrent Neural Networks is linked on the website, along with a deep LSTM model to do machine translation.

(3) Large scale learning and big data challenges, such as those reported on the following links:

- Google MapReduce paradigm to speed up learning algorithms including locally weighted linear regression (LWLR), k-means, logistic regression (LR), naive Bayes (NB), SVM, ICA, PCA, Gaussian discriminant analysis (GDA), EM, and backpropagation (NN)

- Yurii Nesterovs talk about how to solve certain optimization problems that arise from ML in time that is logarithmic in the number of parameters
- A method for distributed feature selection.

(4) Biologically inspired robot learning.

(5) Adaptive processing of graphs (i.e., structures or relations), with applications to bioinformatics, cheminformatics, social networks, document analysis, the Web.

(6) Combination of multiple adaptive classifiers, with applications to statistical/hybrid pattern recognition in image recognition, affective computing, bioinformatics, cheminformatics.

(7) Unsupervised and semi-supervised training of neural networks and computational intelligence paradigms.

(8) Combination of statistical pattern recognition techniques and neural networks for pattern recognition, affective computing, speech processing.

(9) Probabilistic graphical models (and, their combination with neural nets) for pattern recognition.

(10) Kernel machines for pattern recognition.

3.1.3 Reference resources (datasets, evaluation tools)

Resources offered online via the new TC3 website now encompass the following:

- A list (and, comparison) of neural simulators for different operating systems
- Popular Deep Learning Tools - a review
- Recurrent Neural Networks (RNNs) and their application to Pattern Recognition: LSTM Tutorial and open source toolkits (`http://lstm.iupr.com`)
- A benchmark of recognizing objects in images: ImageNet Large Scale Visual Recognition Challenge (Application of Deep learning)

plus other, more traditional ones.

4 Plans (timeline until ICPR2018 and beyond)

We are in the process of organizing the following activities within the next year or so.

4.1 Events

19-21 September 2018: **8th IAPR TC3 Workshop on Artificial Neural Networks in Pattern Recognition** (ANNPR 2018) to be held in Siena (Italy). Chairs: Luca Pancioni, Friedhelm Schwenker, Edmondo Trentin. The review process has completed. 26 papers were selected for presentation at the Workshop. We have two Invited Speakers (M. Gori and M. Pelillo) and a IAPR Invited Speaker (T. Stadelmann).

4.2 Publicity

We (as a TC) freely endorsed the *International Conference on Pattern Recognition and Artificial Intelligence* (ICPRAI 2018), Montral, Canada, in May 2018. Several members of our Leadership Board were involved in the organization, or in the organization of Special Sessions at ICPRAI 2018. This is not an official IAPR endorsement: no money is circulated, neither is the use of the IAPR logo allowed to the ICPRAI organizers. Nonetheless, we advertise the event as a TC3-endorsed event on our website, and the ICPRAI acknowledges the endorsement from TC3 (which is good publicity for the both sides of the agreement). This sort of unconventional endorsement complies with section 6.1 of the IAPR guidelines, which reads: "The following guidelines are meant not to be normative in a rigorous manner which would hinder initiatives and creativity", insofar that the present endorsement is an initiative that benefits the Community and the TC3 (and, in turn, the IAPR implicitly) at no additional costs.

The forthcoming 8th IAPR TC3 ANNPR2018 was widely advertised via major mailing lists (e.g., *Connectionists*) and websites.

The official ANNPR2018 website offers links to both the IAPR as whole and the TC3 itself.

4.3 Other

We are still in the preliminary stage of discussing the feasibility of a **series of open TC3 tele-talks** publicly accessible via streaming over the internet

(some degree of interactivity is under consideration, as well), where recognized experts in our field discuss state-of-the-art topics of interest to the IAPR-TC3 Community and to our fellow scientists. This would be a free service to the Community, and it should widen progressively the list of our active members.

5 Recommendation to ExCo for TC leadership team for 2018-2020 term

The current team has served one term only so far (2016-2018), therefore we recommend confirming the same team for the forthcoming term (2018-2020).