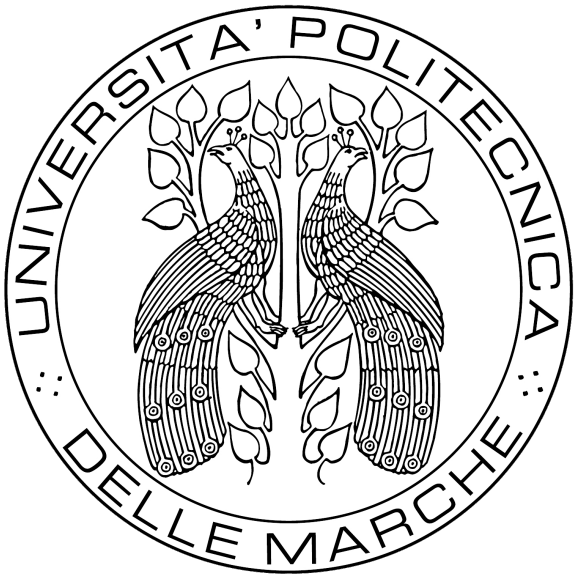
Scuola di Dottorato in Ingegneria dell'Informazione

XVII Ciclo n.s., 3° anno di corso (2017/2018)



Studente: Diego Droghini

Università Politecnica delle Marche
Progetto Eureka

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Ambient Intelligence: Computational Audio Processing For Human Fall Detection

Fall Detection Systems

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State-Of-The-Art

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Motivations and Contributions

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Other Contributions

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Collaborations:

- *Generative raw audio synthesis* by means deep recurrent neural networks
- Deep learning for *timbre modification* and transfer

- Fewshot Siamese Neural Networks employing audio features for *human-fall detection*

Conferences and Workshop

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- **WIRN 2016**: 26th Italian Workshop on Neural Networks, May 18-20 2016, Vietri sul Mare, Salerno, Italy *[1 oral presentation]*
- **EUSIPCO 2017**: 25th European Signal Processing Conference, 28 Ago.-2 Sept. 2017, Kos Island, Greece *[1 oral presentation]*
- **WIRN 2018**: 28th Italian Workshop on Neural Networks, 13-15 June 2018, Vietri sul Mare, Salerno, Italy *[1 oral presentation]*
- **EUSIPCO 2018**: 28th edition of the European Signal Processing Conference, Sept. 3-7 2018, Rome, Italy *[1 poster]*

In addition:

- Speaker: "Le nuove applicazioni dell'Intelligenza Artificiale in ambito musicale", workshop at **Acusmatiq XII** - international festival of electronic, electro-acoustic and experimental music, 28 - 30 July 2017, Ancona, Italy

Training Activity

- **Courses**:
  - "Progettare la ricerca: i progetti europei", Prof. Nicola Paone
  - "Economia e Management del Trasferimento Tecnologico", Prof. Donato Iacobucci
- **Seminars**:
  - "Automated Prominent Nucleoli Detection in Cancer Cells", Dr. Hwee Kuan Lee
  - "Tecniche di Elaborazione Numerica dei Segnali Applicata alla Sintesi della Canna d'Organo", Ing. Carlo Zinato
  - "Robustness Analysis of Binaural Loudspeaker Reproduction", Prof. Risheng Xia - Feb. 21 2017
  - "From signal representations to musical creation: a geometric approach", Dott. Carmine Cella - Mar. 16 2017
  - "Tecnologie Elettroniche nei Centri Dati di Google", Dott. Anthony Tonizzo - May 17 2017

Training Activity

Other:

- Corso di Perfezionamento post laurea in *Computer Music Production* organized by *UnivPm* - **Awarded Certificate**
- Integrative activity organized by the "Contamination LAB" concerning self-entrepreneurship - **Best Pitch Winner** (Team)
- Reviewer for international journals (IEEE Transactions on Emerging Topics in Computational Intelligence, Information Processing in Agriculture) and international conferences (WIRN2016, IJCNN 2017, IJCNN 2018, ICONIP 2018).

Support Teaching Activity

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- Exam supervision for "Macchine e Reti Elettriche" - (C.d.L. Ing. Meccanica)
- Exam supervision and teaching material for "Circuiti ed Algoritmi per Digital Signal Processing" (C.d.L. Ing. Elettronica) and "Digital Adaptive Circuits and Learning Systems" (DAC-LS) (C.d.LM. Ing. Elettronica)
- Tutoring activity for master thesis projects - DAC-LS students
- Lectures on "Computational Audio Processing" at DAC-LS and post-graduate course on "Tecnico per l'applicazione di tecnologie domotiche per gli ambienti di vita"

Publications List (1)

UNIVERSITÀ POLITECNICA DELLE MARCHE

International Journal: *[3 articles, 2 first author]*

[1] E. Marchi, F. Vesperini, S. Squartini, and B. Schuller,
"Deep recurrent neural network-based autoencoders for acoustic novelty detection,"
Computational Intelligence and Neuroscience, 2016.

[2] F. Vesperini, P. Vecchiotti, E. Principi, S. Squartini, and F. Piazza,
"Localizing speakers in multiple rooms by using deep neural networks,"
Computer Speech and Language, 2017.

International Journal (submitted): *[1 article, 1 first author]*

[1] F. Vesperini, L. Gabrielli, E. Principi, and S. Squartini,
"Polyphonic sound event detection by using capsule neural networks,"
Journal of Selected Topics in Signal Processing, 2018, submitted.

International Conference: *[14 articles, 5 first author]*

[1] E. Marchi, F. Vesperini, F. Eyben, S. Squartini, and B. Schuller,
"A Novel Approach for Automatic Acoustic Novelty Detection Using a Denoising Autoencoder with Bidirectional LSTM Neural Networks,"
in *Proc. of ICASSP*, Brisbane, Australia, 19-24 Apr. 2015, IEEE.

Publications List (2)

UNIVERSITÀ POLITECNICA DELLE MARCHE

[2] E. Marchi, F. Vesperini, F. Weninger, F. Eyben, S. Squartini, and B. Schuller, "Non-Linear Prediction with LSTM Recurrent Neural Networks for Acoustic Novelty Detection,"
in *Proc. of IJCNN*, Killarney, Ireland, 12-16 Jul. 2015, IEEE.

[3] F. Vesperini, P. Vecchiotti, E. Principi, S. Squartini, and F. Piazza, "Deep neural networks for multi-room voice activity detection: Advancements and comparative evaluation,"
in *Proc. of IJCNN*, Vancouver, Canada, 24-29 Jul. 2016, IEEE, pp. 3391–3398.

[4] M. Gasparini, F. Vesperini, S. Cecchi, S. Squartini, F. Piazza, and R. Toppi, "Combining evolution strategies and neural network procedures for compression driver design,"
in *Proc. of IJCNN*, Vancouver, Canada, 24-29 Jul. 2016, IEEE, pp. 3385–3390.

[5] P. Vecchiotti, F. Vesperini, E. Principi, S. Squartini, and F. Piazza, "Convolutional neural networks with 3-D kernels for voice activity detection in a multiroom environment,"
in *Multidisciplinary Approaches to Neural Computing*, pp. 161–170. Springer, 2018.

Publications List (3)

UNIVERSITÀ POLITECNICA DELLE MARCHE

[6] F. Vesperini, P. Vecchiotti, E. Principi, S. Squartini, and F. Piazza,
"A neural network based algorithm for speaker localization in a multi-room environment,"
in *Machine Learning for Signal Processing (MLSP), 2016 IEEE 26th International Workshop on*. IEEE, 2016, pp. 1–6.

[7] E. Principi, F. Vesperini, S. Squartini, and F. Piazza,
"Acoustic novelty detection with adversarial autoencoders,"
in *Proc. of IJCNN*, Anchorage, Alaska, 14-19 May 2017, IEEE, pp. 3324–3330.

[8] M. Valenti, D. Tonelli, F. Vesperini, E. Principi, and S. Squartini,
"A neural network approach for sound event detection in real life audio,"
in *Proc. of EUSIPCO*, Kos, Greece, Sept. 2017, IEEE.

[9] L. Gabrielli, C. E. Cella, F. Vesperini, D. Droghini, E. Principi, and S. Squartini,
"Deep learning for timbre modification and transfer: An evaluation study,"
in *Proc. of 144th AES*, Milan, Italy, 24-26 May 2018, Audio Engineering Society.

Publications List (4)

UNIVERSITÀ POLITECNICA DELLE MARCHE

[10] L. Ambrosini, L. Gabrielli, F. Vesperini, S. Squartini, and L. Cattani, "Deep neural networks for road surface roughness classification from acoustic signals," in *Proc. of 144th AES*, Milan, Italy, 24-26 May 2018, Audio Engineering Society.

[11] F. Vesperini, A. Galli, L. Gabrielli, E. Principi, and S. Squartini, "Snore sounds excitation localization by using scattering transform and deep neural networks," in *Proc. of IJCNN*, Rio de Janeiro, Brasil, 8-13 Jul. 2018, IEEE.

[12] F. Vesperini, D. Droghini, E. Principi, L. Gabrielli, and S. Squartini, "Hierarchic ConvNets framework for rare sound event detection," in *Proc. of EUSIPCO*. IEEE, Sept. 3-7 2018.

[13] F. Vesperini, L. Romeo, E. Principi, A. Monteriù, and S. Squartini, "Convolutional recurrent neural networks and acoustic data augmentation for snore detection," in *Proc. of WIRN*, Vietri sul Mare, Italy, 13-15 Jun. 2018.

Publications List (5)

UNIVERSITÀ POLITECNICA DELLE MARCHE

[14] D. Droghini, F. Vesperini, E. Principi, S. Squartini, and F. Piazza,
"Few-shot siamese neural networks employing audio features for human-fall detection,"
in *Proc. of The International Conference on Pattern Recognition and Artificial Intelligence*, Union, NJ, USA, Aug. 15-17 2018.

Others:

F. Vesperini, D. Droghini, D. Ferretti, E. Principi, L. Gabrielli, S. Squartini, and F. Piazza,
"A hierarchic multi-scaled approach for rare sound event detection,"
Ancona, Italy, 2017, DCASE Tech. Report. Copyright-free.

F. Vesperini, L. Gabrielli, E. Principi, and S. Squartini,
"A capsule neural networks based approach for bird audio detection,"
Ancona, Italy, 2018, DCASE Tech. Report. Copyright-free.

L. Gabrielli, F. Vesperini, D. Droghini, and S. Squartini,
"Rima Glottidis: Experimenting generative raw audio synthesis for a sound installation,"
in *XXII Colloquium of Musical Informatics*, Udine, Italy, 20-23 Nov. 2018.