Personal information

Name / Surname	**Simone, Bonechi**
Professional Email	simone.bonechi@unisi.it
Home page	https://simonebonechi.github.io/
Nationality	Italian

Education

ACCADEMIC

2016 – 2020	PhD in Information Engineering (Doctor Europeus) obtained at the Department of Information Engineering and Mathematical Sciences of the University of Siena
Grade	Excellent
Thesis	Lack of Supervised Data: A Deep Learning approach in Image Processing
Tutor	Prof. Monica Bianchini
2011 – 2014	Master's Degree in Computer Engineering – University of Siena
Grade	107/110
Thesis	Automatic Image Classification for the Urinoculture Screening: Culture Ground Identification and Colony Localization
Tutor	Prof. Monica Bianchini
Apprenticeship	Diesse S.p.a., Siena

SUMMER SCHOOL

Jul. 2017	International Summer School on Deep Learning – Bilbao, Spain
Sep. 2017	IEEE Eurasip Summer School on Signal Processing – Capri, Italy
Jul. 2018	Advanced School on Data Science & Machine Learning – Siena, Italy

INTERNSHIP

Jul. 2018 – Jul. 2018	Three months of internship at the Computer Science Department of the University of Copenhagen

Current Position

Jen. 2022 – Current	Junior researcher (article 24, paragraph 3, letter A, Law 30 December 2010, n. 240) at the Department of Social, Political and Cognitive Sciences of the University of Siena

Work Experience

Nov. 2014 – Jen. 2015	External collaborator at Diesse S.p.a. (Siena) for the development of an automatic hardware/software system for the screening of urinary tract infections
Feb. 2016 – Jun. 2016	External collaborator at Quid Informatica S.p.a. (Florence) for the creation of a data mining and document analysis system

Research Activity

Starting from my master degree thesis, I have been involved in several research projects in collaboration with industries (Diesse s.p.a., Quid Informatica s.p.a., and bioMeriéux) in the field of computer vision and machine learning. In particular, I worked on designing a biomedical tool capable of automatically classifying the type and severity of bacterial infections from urine cultures. The developed system can capture images of the culture plate and recognize the presence, type, and severity of the infection. I also worked on implementing a software package to locate text in identity documents (e.g., ID cards, driver's licenses, ...) and digitize it through Optical Character Recognition. Later, my interest shifted to deep neural networks, specifically convolutional neural networks, and I spent the three years of my Ph.D. deepening my knowledge in this area. I implemented and trained various types of deep networks in various applications (text extraction from images, mole and melanoma recognition, retinal fundus segmentation, etc.). The use of these types of networks generally requires a large amount of data, and unfortunately, especially in some fields, labeled datasets are very rare and hard to find. Therefore, my research activities focused on developing solutions to apply these networks in the absence of large amounts of data. In particular, I worked on two strategies. The first is related to a weakly supervised approach to generate pixel–level annotations (using, for example, less precise annotations such as bounding boxes). Another approach is based on the generation of synthetic images. Indeed, by leveraging Generative Adversarial Networks, it is possible to generate synthetic images along with their corresponding labels, which can be used to augment the dataset for training the network. Upon completion of my Ph.D., while working as a research fellow at the University of Tuscia, I collaborated on the "VRAILEXIA" project, funded by Erasmus+. This project aims to build an artificial intelligence and virtual reality–based platform to assist dyslexic students during their university journey. Specifically, I worked on analyzing medical reports of students to extract useful information related to their learning difficulties automatically. Subsequently, I analyzed DNA sequences using Deep Learning techniques during my research fellowship at the University of Pisa in collaboration with GSK Italy. In this case, to overcome the problem posed by the length of DNA sequences, I worked on a solution that uses a vocabulary to segment the sequence into words, which can then be analyzed using two different approaches: one based on Bag of Words and one based on Transformers. Currently, at the Department of Social, Political, and Cognitive Sciences at the University of Siena, I am involved in developing an automatic moderator to be used in a multilingual discussion environment.

Feb. 2015 — Jen. 2016	Scholarship at the University of Siena. Theme: "Development of artificial vision/artificial intelligence software tools to be integrated into automated systems for analysis reporting" (Tutor Prof. Monica Bianchini)
Jul. 2016 – Jun. 2018	Research grant at the University of Siena. Theme: "Development of machine learning and computer vision software tools for the recognition of identity documents and for the profiling of bank loan users" (Tutor Prof. Alessandro Mecocci)
Jul. 2018 -— May 2020	Research grant financed by bioMeriéux Italia S.p.a. at the University of Siena. Theme: "Deep Learning techniques for the segmentation and analysis of medical images" (Tutor Prof. Alessandro Mecocci)
Jul. 2020 — Feb. 2021	Research grant at the University of Tuscia (Viterbo). Theme: "Development of a multi–criteria decision support system for flood risk analysis" (Tutor Dr. Marco Barbanera)
Feb. 2021 – Dec. 2021	Research grant at the University of Pisa. Theme: "Identification of the relevant genetic characteristics in predicting the efficacy of 4CMenB" (Tutor Prof. Corrado Priami)
Jan. 2022 – Current	Junior researcher (article 24, paragraph 3, letter A, Law 30 December 2010, n. 240) at the Department of Social, Political and Cognitive Sciences of the University of Siena

Teaching Support

May 2016	"An Automatic System for the Urinoculture Screening" – seminar, in English, during the course of Bioinformatics (Master's Degree in Computer and Automation Engineering at the Department of Information Engineering and Mathematical Sciences of the University of Siena)
Dec. 2017	"Introduction to Deep Learning" – seminar, in English, during the course of Bioinformatics (Master's Degree in Computer and Automation Engineering at the Department of Information Engineering and Mathematical Sciences of the University of Siena)
Dec. 2018	"A Deep Learning Approach to Bacterial Colony Segmentation" – seminar, in English, during the course of Bioinformatics (Master's Degree in Computer and Automation Engineering at the Department of Information Engineering and Mathematical Sciences of the University of Siena)
Dec. 2019	"Introduction to Deep Learning in Image Processing" – seminar, in English, during the course of Advanced Digital Image Processing (Master's Degree in Computer and Automation Engineering at the Department of Information Engineering and Mathematical Sciences of the University of Siena)
Jen. 2020	Lesson of Deep Learning for image processing (8 hours in English) during the Advanced Digital Image Processing course of the Department of Information Engineering and Mathematical Sciences of the University of Siena
Dec. 2015 – Dec. 2021	Support to students of Bioinformatics and Advanced Digital Image Processing courses in the development of exam projects (Master's Degree in Computer and Automation Engineering at the Department of Information Engineering and Mathematical Sciences of the University of Siena)

Teaching Activity

Nov. 2019	Machine learning and Computer Vision course (12 hours in Italian) for bioMeriéux Italia employees
May 2019 — Jul. 2019	Course of PHP course (40 hours in Italian) within the Digital Media Specialist course organized by the Association of Commerce Tourism Professional Services and SMEs of the province of Arezzo – Confcommercio
Nov. 2020	Course of Deep Learning course for image processing (10 hours in Italian) for bioMeriéux Italia employees
Jul. 2021	Lesson of Deep Learning (6 hours in Italian) for the course of Machine Learning for structural biology of the Executive Master in Bioinformatics and Data Science organized by the University of Siena
Jul. 2021	Lesson of Deep Learning and Tensorflow (3 hours in Italian) during the Summer School Mathematical Methods in Data Science organized by the University of Bari
Dec. 2021	Course of Deep Learning and Tensorflow (8 hours in Italian) for bioMeriéux Italy employees
Jen. 2022 – May 2022	Course of database systems (45 hours in English) for students of the University of Virginia. The course, organized by CET Academic Program, is part of the College Study Abroad project
Sep. 2022	Lesson of Deep Learning (6 hours in Italian) for the course of Machine Learning for structural biology of the Executive Master in Bioinformatics and Data Science organized by the University of Siena

Sep. 2022 – Nov. 2022

Course of Graphic and conversational interfaces (40 hours in Italian) within the Master's Degree Course in Communication Strategies and Techniques at the Department of Social, Political and Cognitive Sciences of the University of Siena

Oct. 2022

Course "From superficial to deep neural networks: what about computational power?" (20 hours in English) within the PhD course in Computer Engineering and Computer Science for the a.y. 2021/2022 organized by the Department of Information Engineering and Mathematical Sciences of the University of Siena

Thesis Co–Advisor

Bachelor degree thesis

- Andrea Mancini, "Implementation of a graphical interface to display the highlights of a skin pigmented lesion image classifier"
- Gioele Vannuccini, "A Neural Network Tool for the Automatic Evaluation of the Bacterial Load in Urinoculture Petri Plates"
- Francesco Gabbrielli, "Evaluating the Importance of Patient Data in the Automatic Urinoculture Analysis"
- Francesco Lorenzini, "Automatic Analysis of Petri Plates Using Support Vector Machines"
- Francesco Guerri, "High Level Visual Feature Extraction for the Urinary Tract Infection Recognition"
- Riccardo Nocella, "Analysis and Development of a Web Application for the Management of the Urinoculture Data"
- Giacomo Cignoni, "Analysis of whole slide images of breast cancer for pd-l1 detection"

Master degree thesis

- Sara Semboloni, "Convolutional neural network for multidomain and multistimulus classification"
- Martina Monaci, "Deep learning techniques for the recognition of dragonfly actions"
- Riccardo Rosai, "Information fusion per la classificazione delle lesioni cutanee da immagini e dati clinici"
- Nicola Giannelli, "Deep learning techniques for the segmentation of images of the aorta"

Orientation activities

Jun. 2022 – Jul. 2022

Orientation lessons during the Artificial Intelligence and Life Sciences Summer School organized for fourth year high school students (3 lessons of one hour in Italian, 17, 24 June and 1 July 2022)

Pubblications

[1] Simone Bonechi. ISIC_WSM: Generating weak segmentation maps for the ISIC archive. *Neurocomputing*, 523:69–80, 2023.

[2] Paolo Andreini, Simone Bonechi, Giorgio Ciano, Caterina Graziani, Veronica Lachi, Natalia Nikoloulopoulou, Monica Bianchini, and Franco Scarselli. *Multi-stage Synthetic Image Generation for the Semantic Segmentation of Medical Images*. pages 79–104. Springer International Publishing, Cham, 2023.

[3] Simone Bonechi. A weakly supervised approach to skin lesion segmentation. In *ESANN 2022 - Proceedings, 30th European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning*, pages 321–326, 2022.

[4] Duccio Meconcelli, Simone Bonechi, and Giovanna Maria Dimitri. Deep learning approaches for mice glomeruli segmentation. In *ESANN 2022 - Proceedings, 30th European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning*, pages 333–338. 2022.

[5] Giovanna Maria Dimitri, Paolo Andreini, Simone Bonechi, Monica Bianchini, Alessandro Mecocci, Franco Scarselli, Alberto Zacchi, Guido Garosi, Thomas Marcuzzo, and Sergio Antonio Tripodi. Deep learning approaches for the segmentation of glomeruli in kidney histopathological images. *Mathematics*, 10(11):1934, 2022.

[6] Paolo Andreini, Simone Bonechi, Monica Bianchini, and Filippo Geraci. MicroRNA signature for interpretable breast cancer classification with subtype clue. *Journal of Computational Mathematics and Data Science*, Page 100042, 2022.

[7] Simone Bonechi, Monica Bianchini, Alessandro Mecocci, Franco Scarselli, and Paolo Andreini. Segmentation of Petri plate images for automatic reporting of urine culture tests. In *Handbook of Artificial Intelligence in Healthcare*, pages 127–151. Springer, 2022.

[8] Paolo Andreini, Giorgio Ciano, Simone Bonechi, Caterina Graziani, Veronica Lachi, Alessandro Mecocci, Andrea Sodi, Franco Scarselli, and Monica Bianchini. A two-stage GAN for high-resolution retinal image generation and segmentation. *Electronics*, 11(1):60, 2021.

[9] Linda Tognetti, Simone Bonechi, Paolo Andreini, Monica Bianchini, Franco Scarselli, Gabriele Cevenini, Elvira Moscarella, Francesca Farnetani, Caterina Longo, Aimilios Lallas, et al.. A new deep learning approach integrated with clinical data for the dermoscopic differentiation of early melanomas from atypical nevi. *Journal of Dermatological Science*, 101(2):115–122, 2021.

[10] Andrea Zingoni, Juri Taborri, Valentina Panetti, Simone Bonechi, Pilar Aparicio-Martínez, Sara Pinzi, and Giuseppe Calabrò. Investigating issues and needs of dyslexic students at university: Proof of concept of an artificial intelligence and virtual reality-based supporting platform and preliminary results. *Applied Sciences*, 11(10):4624, 2021.

[11] Simone Bonechi, Paolo Andreini, Alessandro Mecocci, Nicola Giannelli, Franco Scarselli, Eugenio Neri, Monica Bianchini, and Giovanna Maria Dimitri. Segmentation of aorta 3D CT images based on 2D convolutional neural networks. *Electronics*, 10(20):2559, 2021.

[12] Giorgio Ciano, Giovanna Maria Dimitri, Alberto Rossi, Giorgia Giacomini, Simone Bonechi, Paolo Andreini, and Elisa Messori. Slaide2Voice: A new educational tool for students with visual disabilities. In *CEUR Workshop Proc.*, 2021.

[13] Paolo Andreini, Simone Bonechi, Monica Bianchini, Alessandro Mecocci, and Franco Scarselli. Image generation by gan and style transfer for agar plate image segmentation. *Computer methods and programs in biomedicine*, 184:105268, 2020.

[14] Simone Bonechi, Monica Bianchini, Franco Scarselli, and Paolo Andreini. Weak supervision for generating pixel–level annotations in scene text segmentation. *Pattern Recognition Letters*, 138:1–7, 2020.

[15] Niccolò Pancino, Alberto Rossi, Giorgio Ciano, Giorgia Giacomini, Simone Bonechi, Paolo Andreini, Franco Scarselli, Monica Bianchini, and Pietro Bongini. Graph neural networks for the prediction of protein-protein interfaces. In *ESANN 2020 - Proceedings, 28th European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning*, pages 127–132, 2020.

[16] Martina Monaci, Niccolò Pancino, Paolo Andreini, Simone Bonechi, Pietro Bongini, Alberto Rossi, Giorgio Ciano, Giorgia Giacomini, Franco Scarselli, and Monica Bianchini. Deep learning techniques for dragonfly action recognition. In *ICPRAM*, pages 562–569, 2020.

[17] Simone Bonechi, Paolo Andreini, Monica Bianchini, and Franco Scarselli. COCO_TS dataset: pixel–level annotations based on weak supervision for scene text segmentation. In *International Conference on Artificial Neural Networks*, pages 238–250, Springer, 2019.

[18] Simone Bonechi, Monica Bianchini, Pietro Bongini, Giorgio Ciano, Giorgia Giacomini, Riccardo Rosai, Linda Tognetti, Alberto Rossi, and Paolo Andreini. Fusion of visual and anamnestic data for the classification of skin lesions with deep learning. In *International Conference on Image Analysis and Processing*, pages 211–219, Springer, 2019.

[19] Simone Bonechi, Paolo Andreini, Monica Bianchini, Akshay Pai, and Franco Scarselli. Confidence measures for deep learning in domain adaptation. *Applied Sciences*, 9(11):2192, 2019.

[20] Alberto Rossi, Gioele Vannuccini, Paolo Andreini, Simone Bonechi, Giorgia Giacomini, Franco Scarselli, and Monica Bianchini. Analysis of brain NMR images for age estimation with deep learning. *Procedia Computer Science*, 159:981–989, 2019.

[21] Paolo Andreini, Simone Bonechi, Monica Bianchini, Alessandro Mecocci, and Franco Scarselli. A deep learning approach to bacterial colony segmentation. In *International Conference on Artificial Neural Networks*, pages 522–533, Springer, 2018.

[22] Simone Bonechi, Paolo Andreini, Monica Bianchini, and Franco Scarselli. Generating bounding box supervision for semantic segmentation with deep learning. In *IAPR Workshop on Artificial Neural Networks in Pattern Recognition*, pages 190–200, Springer, 2018.

[23] Paolo Andreini, Simone Bonechi, Monica Bianchini, Alessandro Mecocci, and Vincenzo Di Massa. Automatic image classification for the urinoculture screening. In *International Conference on Intelligent Decision Technologies*, pages 31–42, Springer, 2017.

[24] Paolo Andreini, Simone Bonechi, Monica Bianchini, Andrea Garzelli, and Alessandro Mecocci. Automatic image classification for the urinoculture screening. *Computers in biology and medicine*, 70:12–22, 2016.

[25] Paolo Andreini, Simone Bonechi, Monica Bianchini, Andrea Garzelli, and Alessandro Mecocci. ABLE: An automated bacterial load estimator for the urinoculture screening. In *ICPRAM*, pages 573–580, 2016.

[26] Paolo Andreini, Simone Bonechi, Monica Bianchini, Andrea Baghini, Giovanni Bianchi, Francesco Guerri, Angelo Galano, Alessandro Mecocci, and Guendalina Vaggelli. Extraction of high level visual features for the automatic recognition of UTIs. In *International Workshop on Fuzzy Logic and Applications*, pages 249–259, Springer, 2016.

[27] Paolo Andreini, Simone Bonechi, Monica Bianchini, Alessandro Mecocci, and Vincenzo Di Massa. Automatic image analysis and classification for urinary bacteria infection screening. In *International Conference on Image Analysis and Processing*, pages 635–646, Springer, 2015.

Conferences

Invited Speaker

Nov. 2021 — Italian Workshop on Machine Learning and Data Mining – Workshop of the 20th International Conference of the Italian Association for Artificial Intelligence (AIxIA 2021), 29-30 November 2021. Presentation title: A bag of words approach for genomic sequence analysis: Neisseria meningitidis in carriage and invasive strains

Mar. 2022 — International Conference on Advanced Computing and Intelligent Technologies – ICACIT, March 12-13, 2022. Presentation title: Developing deep learning-based decision support systems in medical imaging: main challenges

May 2022 — Pint of Science (Siena). Presentation Title: Med–AI Revolutionizing Diagnostic Imaging

Chair

Oct. 2022 — Chair of the session "Deep learning, signal, image" at the European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning – ESANN, 5-7 October 2022 - Bruges, Belgium

Organizer

Oct. 2023 — Organizer of the special session "Machine Learning and Deep Learning in Smart Industry" at the 2023 edition of the IEEE International Conference on Metrology for eXtended Reality, Artificial Intelligence and Neural Engineering – MetroXRAINE, October 25-27, 2023 - Milan, Italy

Speaker

Sep. 2015 — Image analysis and processing – ICIAP, 7-11 September 2015, Genoa, Italy. Presentation Title: Automated Image Analysis and Classification for Screening for Urine Bacterial Infections

Feb. 2016 — International Conference on Pattern Recognition Applications and Methods – ICPRAM, 24-26 February 2016, Rome, Italy. Presentation title: ABLE: an automatic bioburden estimator for urine culture screening

Oct. 2018 — International Conference on Artificial Neural Networks – ICANN, October 4-7, 2018 – Rhodes, Greece. Presentation title: A deep learning approach to bacterial colony segmentation

Sep. 2019 — International Conference on Artificial Neural Networks – ICANN, September 17-19, 2019 – Munich, Germany. Presentation Title: COCO_TS Datasets: Pixel Level Annotations Based on Weak Supervision for Scene Text Segmentation

Oct. 2022 — European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning – ESANN, 5-7 October 2022 – Bruges, Belgium. Speaker of two presentation. Title of the first presentation: A lightly supervised approach to segmentation of skin lesions. Title of the second presentation: Deep learning approaches for glomeruli segmentation in mice

Program Commitee

Mar. 2023 – Current
Member of the International Scientific Program Committee of the 2023 edition of the IEEE International Conference on Metrology for eXtended Reality, Artificial Intelligence and Neural Engineering – MetroXRAINE, 25-27 October 2023 - Milan, Italy

Mar. 2023 – Current
Member of the Program Committee of the XIX edition of the International Conference on Artificial Intelligence Applications and Innovations – AIAI, 14-17 June 2023 - León, Spain

Mar. 2023 – Current
Member of the Program Committee of the XXIV edition of the International Conference on Engineering Applications of Neural Networks – EANN, 14-17 June 2023 - León, Spain

Mar. 2023 – Current
Member of the Program Committee of the XII AIUCD Annual Conference, 5-7 June 2023 - Siena, Italy

Editorial Committees

Mar. 2022 – Current
Associate Editor of the journal Neurocomputing published by Elsevier

Sep. 2022 – Current
Guest Editor for the special issue "Mathematical Modeling and Machine Learning Methods for Bioinformatics and Data Science Applications II" in the journal Mathematics published by MDPI

Hackathon

Nov. 2020
Rare Disease Hackathon 2020, Florence, 4-5 November. By participating in the challenge: "At school in the time of Covid-19: from the classroom to DAD and integration" with the project "Slaide2Voice: a new educational tool for students with visual impairments"

Participation to research projects

Nov. 2020 – Feb. 2021
Participation in VRAILEXIA, an Erasmus+ project to build a platform based on artificial intelligence and virtual reality to help dyslexic students. Work on extracting information from medical reports of students with dyslexia

Languages

Mother tongue
Italian

Other languages

Self-assessment
European level

	Understanding		Speaking		Writing
	Listening	Reading	Spoken interaction	Spoken production	
English	Good	Good	Good	Good	Good

Certification
Cambridge FIRST certificate, PET

IT skills

Operating systems	Advanced user knowledge of Linux and Windows. Basic knowledge of macOS
Programming Languages	Python, C/C++, Java, SQL, PHP, HTML, Matlab, Scala, LaTeX
Deep Learning Tools	Tensorflow, PyTorch, Caffè and Matlab Deep Learning Toolbox
Other libraries	OpenCV, Weka, Scikit-learn, Pandas
Database	MySQL, Postgres
Development environments	QtCreator, Eclipse, NetBeans, PyCharm, Intellij
Aoolications	Microsoft Office, OpenOffice, Adobe Photoshop, Gimp