

Curriculum Vitae

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Education and Career

Name: **Fabio Cuzzolin**

Present appointment: **Professor of Artificial Intelligence – Director of the Visual Artificial Intelligence Lab**
(<http://cms.brookes.ac.uk/staff/FabioCuzzolin/>)

Education and qualifications

1998-2001 – University of Padua, Italy: **Ph.D. in Industrial Electronics and Computer Science**

1991-1997 – University of Padua, Italy: **Laurea Degree magna cum laude in Computer Engineering**

Previous appointments

- 2016-now – **Professor of Artificial Intelligence**, School of Engineering, Computing & Mathematics,
Oxford Brookes University
- 2018-2020 – **Executive Committee member, Joint Huawei-SFU Research Center**, Vancouver, Canada
- 2008-now – Oxford Brookes University, Department of Computing and Communication Technologies
Head of Artificial Intelligence and Vision Research Group (2012-present); **Reader** (September 2011-December 2015); **Senior Lecturer** (July 2011-September 2011); **Lecturer and Early Career Fellow** (September 2008-July 2011)
- 2006-2008 – INRIA Rhône-Alpes - *Institut National de Recherche en Informatique et en Automatique*
Marie Curie fellow
- 2004-2006 – University of California at Los Angeles, Computer Science Department
Postdoctoral researcher, UCLA Vision Lab
- 2003-2004 – Politecnico di Milano, Department of Electronics and Information Theory
Giovane ricercatore
- 2001-2003 – University of Padua, Department of Electronics & Computer Science: **Postdoctoral researcher**
- 2000 – Washington University in St Louis, Electronic Systems and Signals Research Laboratory (ESSRL)
Visiting scholar

Professor Fabio Cuzzolin graduated *magna cum laude* in Computer Engineering from the University of Padua (*Universitas Studii Paduani*). Founded 1222, Padua currently ranks #2 among Italian universities and was judged Italy's top-rated university for research quality in the first two reports by the country's National Evaluation Agency for University System (ANVUR). He received a Ph.D. degree there in 2001 for a thesis entitled 'Visions of a generalised probability theory'. He was later with the Washington University in St. Louis (16th in 2021 US rankings), Politecnico di Milano (the top Italian university and #137 worldwide in the QS 2021 global ranking) and the University of California at Los Angeles (the 2nd best public university in the world, and 11th overall in 2019), before been awarded a Marie Curie Fellowship at INRIA Rhone-Alpes, France. In 2006-7

he classified second at INRIA's national *Chargée de Recherche* (CR1) recruitment, and joined Oxford Brookes as an Early Career Fellow in 2008. In 2012 he founded the Artificial Intelligence and Vision research group there, now the Visual Artificial Intelligence Laboratory (VAIL). He is a Professor of Artificial Intelligence since 2016.

1 Research Profile Overview

Research Interests

As the founder and Director of Brookes' Visual Artificial Intelligence Laboratory I have been conducting work at the boundaries of **human action recognition**. My team has built since 2015 a leadership position in the field of deep learning for action detection and recognition, which has led to be best detection accuracies to date and the first system (October 2017) able to localise multiple actions on the image plane in (better than) real time. In my team we are working to tackle frontier challenges such as: (i) the design of deep learning architectures able to regress whole action 'tubes' in real time; (ii) the deep modelling of complex activities performed by multiple agents over a period of time, (iii) the captioning of videos in natural language by modelling the semantics of words, (iv) multimodal deep learning for the detection of complex audio-visual events, & (v) the creation of a theory of mind for machines. In the past I proposed spectral embedding techniques for unsupervised 3D segmentation and matching which have been rather highly cited (see Google metrics) and led to an IJCV paper. Our 2012-15 work on action and activity recognition via discriminative part-based models, in partnership with Oxford's Torr Vision Group, generated an IJCV paper and prizes at MLVR and BMVC.

I am a recognised leader in the field of **uncertainty theory and belief functions**, as conference chair, four-term member of the Board of Directors of the Belief Functions and Applications Society (BFAS), former Executive Editor of SIPTA (the Society for Imprecise Probabilities) and editor of journals such as IJAR and IEEE TFS. My reputation there comes from the formulation of a geometric approach to uncertainty in which various measures are analysed by geometric means. This work has led to two monographs, two edited volumes and various tutorials and invited talks at top universities and venues. More in general, I am widely contributing to the mathematical foundations theory of random sets (generalised laws of probability, generalised statistical inference and random variables), with the aim to make it a viable alternative to probabilistic reasoning.

Within **artificial intelligence** at large my work is directed at providing new robust foundations for statistical learning theory via uncertainty theory, and developing novel tools based on the theory of random sets, e.g. the generalisation of the logistic regression and max-entropy classification frameworks. In the past I also worked on manifold learning for dynamical models (PAMI 2014 paper), and the generalisation of bilinear classifiers to the tensorial case (EPSRC First Grant). Since 2016 my interests and the activities in my group have been expanding towards **surgical robotics** (H2020 SARAS project of which I am Scientific Officer), **AI for healthcare** (joint papers and bids with Prof Helen Dawes and Prof Derick Wade), **cognitive artificial intelligence** (2019 Leverhulme machine theory of mind grant with Cambridge Neuroscience) and **autonomous driving** (via a collaboration with Federico II University, Naples, and a recent ECM-funded project). Very recently I have been strongly promoting the injection of second-order uncertainty into the very **foundations of artificial intelligence**, in particular through my recent H2020 FET 'Epistemic AI'.

Publication Record and Awards

To date I am the author of **some 110 peer-reviewed publications**, published or under review. In particular I am sole author of two monographs, editor of two LNCS volumes, and author of 25 journal papers or book chapters. Lambert Academic (LAP) has published a heavily revised version my Ph.D. thesis "Visions of a generalized probability theory" as a monograph in September 2014. I was the sole Editor of the volume "Belief functions: theory and applications" - BELIEF 2014 Proceedings, and co-Editor for the "Belief functions: theory and applications" BELIEF 2018 LNCS volume. My **866-page monograph "The geometry of uncertainty – The geometry of imprecise probabilities"**, collecting my original ten-year work on this topic, was published by Springer Nature in January 2021 (<https://www.springer.com/gb/book/9783030631529>).

My work has won **various awards and recognitions** in recent years. One of my papers won the best paper award at the 2008 Pacific Rim Conference on Artificial Intelligence (PRICAI'08); another one was shortlisted for best paper at the ECSQARU'11 conference. I was the recipient of a best poster award at the 2011 International Symposium on Imprecise Probabilities (ISIPTA'11), while my PhD student Michael Sapienza and I received a poster prize at the 2012 INRIA Summer School on Machine Learning and Visual Recognition. Our joint work was also shortlisted for best paper at BMVC'12, where I received an Outstanding Reviewer Award. In 2013 I received the Next 10 Award from the Faculty of Technology as one of its top emerging researchers. My student

Suman Saha won the reading group prize at the 2015 International Computer Vision Summer School (ICVSS). More recently, my team and I secured 2nd place in both the 2016 and 2017 CVPR activity detection challenges (ActivityNet and Charades). After a 3rd place in the first edition of the IMEC-sponsored Formula Student – AI competition, my team and I have assisted the Oxford Brookes Racing – Autonomous team in winning the 2020 edition, achieving overall first place in the UK.

Esteem Indicators

I was the **Program Chair of the 3rd International Conference on the Theory of Belief Functions (BELIEF 2014)**, and on the **Steering Committee of the joint SMPS-BELIEF 2018** event. I am a four-term member of the Board of Directors of the Belief Functions and Applications Society (BFAS) which organises the BELIEF series of conferences, and was Executive Editor of SIPTA (the Society for Imprecise Probabilities). I am currently Associate Editor the International Journal of Approximate Reasoning (IJAR), Guest Editor for the IEEE Transactions on Neural Networks and Learning Systems (IF 11.683), and Topic Editor for Frontiers in Artificial Intelligence. I was also on the editorial board of IEEE Transactions on Fuzzy Systems, the top journal in computer science by 2015-16 impact factor, the IEEE Transactions on Systems, Man, and Cybernetics C and Information Fusion. I am in stand-by to be named for the board of IEEE Transactions on Pattern Analysis and Machine Intelligence, the top vision and machine learning journal.

I have served in the **Program Committee of 100+ international conferences, including all top venues in AI (IJCAI, ECAI, AAAI), machine learning (NeurIPS, ICML), computer vision (ICCV, CVPR, ECCV, ACCV), uncertainty theory (UAI, BELIEF, ISIPTA, FUZZ-IEEE, SMC).**

I am currently serving as Area Chair for ECCV (the European Conference on Computer Vision) and the International Conference on Computer Vision (ICCV), the top computer vision venue. I have been Area Chair for **UAI (Uncertainty in Artificial Intelligence) and BMVC (the British Machine Vision Conference)** for several years. Since 2017 I am a Reviewer for ERC (the **European Research Council**) and a **Member of the EPSRC Associate College** of reviewers. I was REF2021 external assessor for UoA 11 of Wolverhampton University. I was **invited or keynote speaker** at a number of conferences and summer schools, including CSA 2016, BFF4 and BFF5, BELIEF 2017, COSUR 2018, ICRA 2019 and the 2019 Hamlyn symposium, and I have given tutorials and invited seminars at Harvard, Oxford, Cambridge, and Seoul National University, among others.

Funding

To date I attracted direct external funding for a **total of circa £5,000,000**, of which around **£3.7M since 2018**, including the recent H2020 FET I am coordinating. In addition, I am overall **Scientific Officer for the €4.3M Horizon 2020 project SARAS**, which I co-wrote with the Coordinator Riccardo Muradore from University of Verona, and I am **Lead Team member and advisor for the recent £1,257,000 Research England Development (RED) funded Oxford Brookes Artificial Intelligence & Data Analysis Incubator (AIDA)**, which is co-funded by Oxford Brookes for an additional £654,000. I was also awarded over the years by the university internally-funded studentships for the equivalent of **£416,000**.

More in detail, I was awarded in 2011 a £122K EPSRC First Grant for the project “Tensorial modeling of dynamical systems for gait and activity recognition” which generated three journals papers on PAMI, IJCV and IEEE TFS, and a number of follow-up grant applications. I was Academic Supervisor for a £160,000 Knowledge Transfer Partnership (KTP) with Meta Vision LTD, and I am Lead Academic for a new £190,000 KTP with Createc and Sportlight (two Oxford spinoffs) on activity recognition for sports analytics. In 2019 I also signed a research agreement with Huawei Technologies worth £278,000, and was awarded as the PI a £273,000 Research Grant by the Leverhulme Trust, in collaboration with Cambridge University’s Barbara J. Sahakian, for research on machine theory of mind at the interface of AI and neuroscience. In addition, I received UKIERI-British Council funding for an exchange programme with IIT Bombay – my partner in the project is the new Director of IIT Bombay, Prof Subhasis Chaudhury. As recently as October 2020 I won funding as the Coordinator for a €3M Future Emerging Technologies (FET) project “Epistemic AI”, with KU Leuven and TU Delft as partners (own share €1.208 millions). FETs are notoriously very competitive, with a success rate of around 5%.

In addition, the Visual AI Lab annually receives a few thousand pounds in QR (Quality of Research) money from the School, as a result of our REF 2014 performance. **Several sizeable grant applications are pending, for a total value (own share) as of January 2021 of £853,000** (see Grants list), not including venture capital we are seeking to fund our Olympia.ai start-up. In early 2018 I led as the **PI and Director Brookes’ bid for a UKRI-funded Doctoral Training Centre in Human-Centric Artificial Intelligence** (£5,647,459) involving 9 Co-Is across the University, which regrettably was not admitted to the final stage (only 10% of proposals, 35/360 were).

2 Research Leadership

Leadership of the Visual Artificial Intelligence Laboratory

The Visual Artificial Intelligence Laboratory, which I funded in 2012 under the name first of Artificial Intelligence and then of AI and Vision group, is now a vibrant and fast growing team **projected to comprise 30+ people in 2021**, including 5 members of staff (Cuzzolin, Rast, Rolf, Olde-Scheper, Bradley), 2 KTP associates, 8 postdocs and research fellows, 6 PhD students, 1 administrator, 3 MSc and 3 UG students, 6 external collaborators. The Lab is one of the largest in the University, and has established itself as one of the **top research groups in the world in deep learning for action detection**, conducting work at the boundary of human action recognition, in the company of vision groups at Oxford, UC Berkeley and INRIA. Former students of mine have moved on to postdoc or PhD positions in world class universities (Oxford, Cambridge, ETH, Stanford), and our work in the field is internationally recognised. That was achieved thanks to our team being runner-up in the 2016 and 2017 CVPR Activity Detection competitions, the dramatic increase in performance contributed by our 2016 and 2017 papers in this topic, and our creation of the first real-time action detection approach, which has attracted attention from Amazon, Huawei, Anyvision and others. This is evidenced by the rapidly increasing citation counts for papers 58, 59 and 61, the sheer amount of external funding secured in the past two years, and my recent inclusion in the TCPs of NeurIPS, ICML, CVPR, ICCV, ACCV, ICCV and ECCV (the last two as Area Chair). The Lab is **pioneering frontier topics** such as future action prediction, the modelling of complex activities via deep neural architectures, machine theory of mind, continual learning and epistemic artificial intelligence. As mentioned, **further funding is being sought to support our expansion** into (mobile and surgical) robotics, AI for healthcare, machine learning and general artificial intelligence, through both neuroscience-inspired AI and the modelling of epistemic uncertainty in artificial intelligence.

An Oxford Advanced Artificial Intelligence Institute (AI²)

My overarching ambition in the medium term (5 years from now) is to create an **Oxford Advanced Artificial Intelligence Institute (AI²)**, consolidating my effort in all the frontier topics we conduct work on, possibly in collaboration with both of Oxford's universities, the Institute for Ethical AI I am a core member of, and venture capital to obtain through my industrial network.

Scientific Advisor for the Vancouver IC Lab

As a senior academic advisor for Huawei Canada's IC Lab in Vancouver I oversee in remote the research activities of the group, and specifically advise several sub-team leaders. The team consists of around 18 people in late 2020. Its research activities are subdivided into teams around specific topics, spanning a number of cutting edge research topics in computer vision and machine learning.

Leadership of the community of belief functions and uncertainty theory

Since 2014 I have been taking consistent steps to assume a **leadership role in the field of uncertainty theory**, in particular the community active in belief functions and random sets. As the Program Chair of the 3rd International Conference on the Theory of Belief Functions (BELIEF 2014), Steering Committee member of SMPS-BELIEF 2018 and four-term member of the Board of Directors of the Belief Functions and Applications Society (BFAS), I initiated a number of activities with the medium-term goal of expanding the boundaries of the community, by involving the large number of practitioners who actually use belief functions in their field of application and by reconnecting with mainstream statistics. My other main objective is to link uncertainty theory firmly to the wider artificial intelligence, to disseminate the knowledge of random set and belief function-based approaches among AI researchers, and to improve the overall impact of our work in the area. This objective has received a significant confirmation thanks to the funding I won for my epistemic AI research programme. I conducted a tutorial campaign to increase the awareness of belief theory and its practical uses, including my UAI 2015 and IJCAI 2016 tutorials, an invited seminar at Harvard Statistics, an invited tutorial at Seoul National and invited talks at various conferences and summer schools. This multi-year work has eventually led to a Springer Nature monograph that was viewed 50,000 times on LinkedIn. I also envisage, in collaboration with my colleagues, the creation of a **general uncertainty conference** which will give to the field the visibility it deserves.

Networks of collaborations

Within the School of Engineering, Computing and Mathematics I have been actively promoting best practice in order to improve our record of attracting external funding. On my suggestion the Computing section is now holding regular rounds of internal review of every grant being submitted. I work very closely with the AI and Robotics group and the Institute for Ethical AI. My team, in consortium with Dr Matthias Rolf and Dr Andrew Bradley (head of the new Autonomous Driving group) has been awarded ECM funding for a 2-year Research Fellow and a PhD student in AI for Autonomous Driving.

Across the University I am in the **Steering Board of the OxCATTS clinical trial unit, the new Institute for Ethical AI, and the Healthy Ageing** network. I work very closely with Professor Helen Dawes, Director of the MORES centre, on the use of AI for the early diagnosis of dementia, the self-management of multiple morbidities and, most recently, the monitoring of people in a coma and the use of machine theory of mind to communicate with cognitive impaired people in care homes. This has led so far to two 2014 and 2019 EPSRC bids which received good scores but were not funded, and a journal paper on Gait and Posture. With Dawes we participated in the Row for Parkinson's initiative (see Media) by analysing the footage recorded during the effort. As of 2018 I led as the PI and Director Brookes' bid for a UKRI-funded Doctoral Training Centre in Human-Centric Artificial Intelligence (£5,647,459) involving 9 Co-Is across the University, spanning Engineering and Computing, Built Environment, Health Sciences, Psychology and Law. I have since been invited to support a possible resubmission of the £6M University's Expanding Excellence in England bid led by Dawes and Gupta.

National and International. I am now Coordinator for the new H2020 FET "Epistemic AI", with as partners TU Delft (Prof Yorke-Smith) and KU Leuven (Dr Shariatmadar). I am as well overall Scientific Officer for the H2020 SARAS project, which includes 9 partners throughout Europe. As such I strongly collaborate with the SARAS Coordinator University of Verona and their ALTAIR lab led by Paolo Fiorini. I am exploring exchange visits to and from China (Renmei, Petroleum and Xian universities) and India (IIT Bombay, via UKIERI). The Visual AI Lab works very closely with Oxford University's Torr Vision Group in terms of joint publications, exchange of personnel and sought funding applications and spinoff initiatives. We also work with Prof Lukasiewicz (on the semantics of video captioning) in Oxford CS, and with Prof Sahakian (Cambridge University) on theory of mind (Leverhulme grant). I initiated an Erasmus+ Traineeship scheme with University Federico II Naples, which has led to several visiting students (Di Maio, Fontana) and a possible joint PhD studentship funded by Fiat Chrysler. I am currently exploring joint funding with Imperial College London on surgical robotics, with KTH Sweden on big data, with Fraunhofer Institute on automated inspection, among others. I am also participating in the setting up of a European COST action in imprecise probabilities, and have strong links with the Department of Statistics of Harvard University (Arthur Dempster, Xiao-Li Meng) in virtue of my work on random set theory. I maintain significant connections with the Department of Math Sciences at Durham University (Dr Matthias Troffaes and Professor Frank Coolen), Professors Jonathan Lawry and Weiru Liu at Bristol University, INRIA Rhone-Alpes's Radu Horaud, Professor Thierry Denoeux at Université de Technologie de Compiègne (via the Belief Functions Society), Oxford University Professor and Director of the Environmental Change Institute Jim Hall, Professor Lourdes Agapito at University College London, Professor Adrian Hilton at U. Surrey, and many others. I have been publishing joint papers with INRIA, the University of Milan, Oxford University, Harvard University. Details on my company collaborations are provided later.

Supervised students, researchers and collaborators

Postdoctoral Researchers and Research Fellows (11, vs 4 in Sep 2018): **Ajmal Shahbaz**, funded by the Huawei agreement (Jan 2021-2023); **Bogdan-Ionut Cirstea**, funded by the Leverhulme Trust (Feb 2020-now); **Reza Javanmard Alitappeh**, funded by ECM School fellowship (Apr 2019 – Nov 2019); **Inna Skarha-Bandurova**, **Vivek Singh**, **Dinesh Jackson Samuel** (Aug 2019 – Dec 2020), **Mohamed Ibrahim Mohamed** (Dec 2019 - now), funded by the SARAS Horizon 2020 project; **Suman Saha** (Dec 2017 – Jul 2018), now postdoc at ETH Zurich; **Ruomei Yan** (Sep 2017 – Dec 2017), now with ARM Semiconductors; **Ahmed Samet** (Apr – Jul 2017), now Assistant Professor (Maitre de Conference) at University of Strasbourg; **Wenjuan Gong** (Feb 2013 – Jan 2014), funded by my EPSRC First Grant, Project title: "Tensorial modeling of dynamical systems for gait and activity recognition", now Lecturer at China University of Petroleum.

KTP Associates (2, vs 1 in Sep 2018): **Neha Bhargava** (May 7 2019 – 21), funded by the Createc KTP; **Ruomei Yan** (Sept 2015 – Aug 2017), funded by the Meta Vision KTP "Sensing a good weld: new applications in computer vision" (formerly a Lecturer at Shanghai Chan-Mai, 3rd best Chinese university).

Doctoral Students (9, vs 5 in Sep 2018): (as Director of Studies, unless otherwise indicated): **Michael Sapienza** (Oct 2011 - Oct 2014), Thesis title: "Recognising and localising human actions" (now with Samsung Global

Research, formerly postdoc at Oxford University, Department of Engineering Science); **Vinhav Vineet** (January 2014 - October 2014), second supervisor, thesis title: "Recognition, Reorganisation, Reconstruction and Reinteraction for Scene Understanding" (later postdoc at Stanford University); **Min Han Lee** (Sep 2014-Aug 2015), Topic: "Action recognition from unconstrained videos"; **Suman Saha** (Sep 2014-Apr 2018), Topic: "Uncertainty in Computer Vision", Winner of best MSc dissertation at University of Bedfordshire (now postdoc at ETH Zurich); **Gurkirt Singh** (Sep 2015-2019), Topic: "Real-time Action Recognition for Human-Robot Interaction" (now also a postdoc at ETH Zurich); **Wojtek Buczynski** (Oct 2018 - now), based at Cambridge University, second supervisor (DoS Barbara Sahakian); **Salman Khan** (Feb 2020 - now), funded by the research agreement with Huawei Technologies; **Devashish Bharti** (April 2020-now), topic: "Federated learning for model adaptation"; **Izzedin Teeti** (from Jan 2021), topic: "Intelligent Transport Systems".

Visitors (13, vs 10 in Sep 2018): **Rocco de Rosa** (January 2014 - July 2014), EU Erasmus Training Programme (now Data Science Manager at Rank Group, formerly a postdoc at University of Rome "La Sapienza"); **Serdar Buyukkanli** (June 2014 - September 2014), funded by EU Erasmus Training Programme; **Brenda Romino** (February 2016 - August 2016); **Manuele Di Maio** (March 2017 - September 2017), Erasmus+ trainee; **Andrea Morelli** (January 2017 - May 2017), Erasmus+ trainee; **Shashwat Shukla** (May-Jul 2017), Oxford Brookes - IIT Bombay exchange programme; **Santanu Rathod** (May-Jul 2018), Brookes - IIT programme; **Valentina Fontana** (Mar-Sep 2018), Erasmus+ trainee from Naples' Federico II; **Giacomo De Rossi** (Sep-Nov 2018), University of Verona; **Silvio Olivastri** (Mar-Jun 2018; Mar 2019), AI Labs, Bologna; Dr **Filippo Vella** (Jan 2019), researcher at CNR Palermo, Italy; Prof **Ahmad Osman** (Aug 2019), Professor at Fraunhofer Institute, Saarbrücken, Germany; Prof **Biplab Banerjee** (Feb 2020), Assistant Professor at IIT Bombay, India.

MSc Students (16, vs 11 in Sep 2018): Brad Lishman (2012), Stephane Bourgeois (2014), Jonathan Pound (2014), Paula Rocafull (2015), Ben Guy (2016), Kurt DeGiorgio (2016), now MPhil student at Cambridge University, Misbah Munir (2016-17), Stavros Gasparis (2017), K. Parshotam (2017), Stephen Akkrigg (2018), Francis Kaping'A (2018), Parijat Patel (2019), Anudeep Chikkam (2019-2020), Hui Li (2020), Adam Gibson (2020), Mark Edward (2020).

I was external examiner for PhD candidates Andrea Argentini, University of Trento, in 2012 (title of the thesis: "Ranking Aggregation Based on Belief Function Theory"), Zhenghua Xu, Oxford University, Timber Kerkvliet, VU University Amsterdam, and for the *habilitation* of John Klein (Lille University, France). I have been internal for Ph.D. candidates Chris Russell (title: "Higher-order inference for vision problems") and Paul Sturgess (April 2016). I have been invited to act as external at KTH Sweden and University of Belfast in the autumn of 2018. In May 2020 I was external for Farnoosh Heidarincheh, University of Bristol ("Action completion recognition and detection").

3 Esteem Indicators

Awards

First place overall in IMechE Formula Student – AI 2020	July 2020
Overall UK winner in both Dynamic Driving Task and Autonomous Vehicle Simulation Development	
Third place in IMechE Formula Student - AI 2019 (with the Autonomous Driving team)	July 2019
https://www.imeche.org/events/formula-student/team-information/fs-ai	
2017 CVPR Charades challenge, 2nd place (with student G. Singh)	Jun 2017
http://vuchallenge.org/charades.html (1st place won by Google Deepmind's TeamKinetics)	
2016 CVPR ActivityNet action detection challenge, 2nd place (with student G. Singh)	Jun 2016
Next 10 Award - Oxford Brookes University - Faculty of Technology	Oct 2012
Research accelerator programme, awarded to the top emerging researchers in the Faculty	
Outstanding Reviewer Award - British Machine Vision Conference (BMVC 2012)	Sep 2012
<i>Short-listed for the Best Paper Award</i> - British Machine Vision Conference (BMVC 2012)	Sep 2012
for the paper: "Learning discriminative space-time actions from weakly labelled videos"	
Best Poster Prize - INRIA Visual Recognition and Machine Learning Summer School (VRML 2012)	July 2012
for the poster: "Learning discriminative space-time actions from weakly labelled videos"	
Best Poster Award - Int Symp on Imprecise Probabilities: Theories and Applications (ISIPTA'11)	July 2011
for the poster: "Geometric conditional belief functions in the belief space"	
<i>Short-listed for the Best Paper Award</i> - ECSQARU 2011	Jun 2011
for the paper "On consistent approximations of belief functions in the mass space"	
Best Paper Award - Pacific Rim International Conference on Artificial Intelligence (PRICAI'08)	Dec 2008

“Alternative formulations of the theory of evidence based on basic plausibility & commonality assignments”

Marie Curie fellowship

Sep 2006

In addition, my former PhD student Suman Saha won the **reading group prize at ICVSS 2015**, the International Computer Vision Summer School. My MSc student Misbah Munir has won in February 2017 the **OBSEA (the Oxford Brookes Social Entrepreneur Awards) Try It Award** to fund a proof of concept of her work. PhD student Gurkirt Singh has won a **Best Reviewer Award at ICCV 2019**, the top computer vision conference.

Organisation of International Conferences

I was the **General Chair** and local organizer of the 3rd International Conference on the Theory of Belief Functions (BELIEF 2014), held in St. Hugh's college, Oxford, UK, September 26-28 2014. I was Co-organizer of WPMSIIP 2011 - 4th Int. Workshop on Principles and Methods of Statistical Inference with Interval Probability. I was in the **Steering Committee (Program Chairs) of the joint SMPS-BELIEF 2018** international conference.

Membership of Editorial Boards and Societies

- **Steering Committee** member of the new **Oxford Brookes Institute for Ethical Artificial Intelligence** (Feb 2020-now)
- **Oxford Clinical Allied Technology and Trials Services Unit (OxCATTS)** Steering Group member (2019-now)
- **Executive Committee** member of the **Huawei Technologies Canada – Simon Fraser University** joint Visual Computing Research Lab (2018 - 2020)
- Associate Editor of the **International Journal of Approximate Reasoning** (2018 - now)
- Guest Editor for the **IEEE Transactions on Neural Networks and Learning Systems** (impact factor 11.683) (Jan 2020 – now)
- Research Topic Editor for **Frontiers in Artificial Intelligence: ‘Theory of Mind in Humans and in Machines’** (Oct 2020-now), with Barbara J. Sahakian and Bogdan-Ionut Cirstea
- Associate Editor of the **IEEE Transactions on Fuzzy Systems** (2013 - 2017)
- Associate Editor of the **IEEE Transactions on Systems, Man, and Cybernetics C** (Jan 2011 - March 2013)
- Guest Editor of the International Journal of Approximate Reasoning (October 2014 - present)
- Guest Editor of **Information Fusion** (2009 - 2012)
- Four-term member of the **Board of Directors of the Belief Functions and Applications Society (BFAS)**
- **Executive Editor** of the Society for Imprecise Probabilities – Theory and Applications (SIPTA), 2017-2019
- I was a member of the British Machine Vision Association and the IEEE Systems Man Cybernetics society

Membership of Funding Bodies and Panels

I am a Reviewer for **ERC - the European Research Council** since 2017, Reviewer for the Italian Ministry of Scientific Research, and I am a Member of the **Associate College of reviewers for EPSRC** (2017-now). I am REF2021 external assessor for UoA 11 the University of Wolverhampton (as of August 2018). I have also reviewed grant applications for the **Leverhulme Trust** and the **Vienna Research Group**, Austria.

Membership of Conference Program Committees

I have served in the **Technical Program Committee of 100+ international conferences**, including the top venues in Artificial Intelligence, Machine Learning, Computer Vision and Uncertainty Theory: **IJCAI 2016-2020** - the top conference in Artificial Intelligence; **ECAI 2018**; **NeurIPS 2018-2020** (the top machine learning venue); **ICML 2018-2020 (the International Conference on Machine Learning)**; **AAAI 2020** (the Association for the Advancement of Artificial Intelligence series of conferences); **UAI (Uncertainty in Artificial Intelligence) 2014-2019 as Senior Program Committee** member (Area Chair); **BMVC (the British Machine Vision Conference) 2009-2020**, as **Area Chair** 2016-19; **ECCV (the European Conference on Computer Vision) 2020**, as **Area Chair**; **ICCV (the International Conference on Computer Vision) 2020** as **Area Chair**; **IEEE CVPR (Computer Vision and Pattern Recognition)**; **SMC (the IEEE International Conference on Systems, Man, and Cybernetics) 2013-2020**, Main Track. Others major venues include **FUSION 2017-19** - the International Conference on Information Fusion, **IPMU 2014-2020** - the Information Processing and Management of Uncertainty series of conferences; **ACCV 2014, 2018** - The Asian Conference of Computer Vision; **VISAPP 2006-2019** - International Conference on Computer Vision Theory and Applications; **FLAIRS 2008-2018** - the Florida AI Research Society International Conferences; **ISIPTA 2009-2021** - the International Symposium on Imprecise Probabilities and Their

Applications; ECSQARU 2009-19 - the Eur. Conf. on Symbolic and Quantitative Approaches to Reasoning with Uncertainty; BELIEF 2010-2021 - The International Conference on the Theory of Belief Functions; AVSS 2013-2014 - the IEEE International Conference on Advanced Video and Signal-Based Surveillance; IUKM2010-2020 - the Int. Symposium on Integrated Uncertainty in Knowledge Modelling and Decision Making.

Invited Talks and Seminars

I was invited to give **seminars at a host of national and international institutions**, including Oxford University's Department of Engineering (Feb 13 2018), Harvard University's Department of Statistics (July 14 2016), Cambridge University's Department of Engineering (March 2016), Microsoft Research Europe (2006), GeorgiaTech (2006), Pompeu Fabra University (2006), EPFL-IDIAP (2006), MIT (1999). In 2015 I was invited by the Oxford Martin School to join a select group of Oxford Academics to meet with former World Chess Champion Garry Kasparov and discuss some of the future challenges of AI. I was invited again in March 2017.

In recent years I was **invited speaker or keynote speaker** at a number of events:

- the CSA 2016 international conference (Algiers, Dec 2016);
- the 2017 BMW Knowledge Day (February 2017);
- the 4th Summer School on Belief Functions (Xian, China, July 2017);
- the Roadmap to Autonomous Surgery Workshop, Verona, Italy, Oct 31 2017;
- the Oxford Prospects Programme (St Cross and Regent's colleges, Oxford, Jan 31/Jul 31 2018);
- the Ambassadors' Roundtable on AI of the Anglo-Israel Association (Royal Society, London, Feb 27 2018);
- the Bayesian, Fiducial and Frequentist Workshop (BFF4), Harvard, May 2017 (refused for family reasons);
- the Fifth Bayesian, Fiducial and Frequentist Workshop (BFF5), Ann Arbor, USA, May 6-9 2018;
- the 2nd Biennial Summer School on Surgical Robotics (COSUR 2018), Verona, Italy, July 10 2018;
- the ICRA 2019 workshop "Next Generation Robotic Surgery: Seamless integration of Machine Learning, Knowledge Representation and Robotics within the operating rooms", Montreal, Canada, May 2019 <https://nxgsur-icra2019.sciencesconf.org/>;
- the Hamlyn Symposium Workshop "Towards robotic autonomy in surgery", London, June 23 2019, <https://www.ukras.org/hamlyn/workshops/towards-robotic-autonomy-in-surgery/>.
- **Cambridge Science Festival** - Artificial Intelligence, the Human Brain and Neuroethics, March 2020 (cancelled because of Covid) <https://www.clarehall.cam.ac.uk/events/cambridge-science-festival-artificial-intelligence-human-brain-and-neuroethics>

Organisation of Tutorials, Challenges, Special Issues and Special Sessions

- "Belief functions: A gentle introduction", invited tutorial, Seoul National University, June 1 2018
- "Belief functions for the working scientist", International Joint Conference on Artificial Intelligence (IJCAI-16), New York, July 2016
- "Belief functions for the working scientist", Uncertainty in Artificial Intelligence (UAI) 2015, Amsterdam
- Special Issue "Selected papers from BELIEF 2014", Int. Journal of Approximate Reasoning, 2015-16
- Special Issue "Information Fusion Applications to Human Health and Safety", Information Fusion, Elsevier, Volume 13, Issue 2, 2012; Co-editors: Paul Snow and Al Ozonoff (Harvard University)
- Special Session: "Belief functions, Symbolic and Quantitative Approaches to Reasoning with Uncertainty" (ECSQARU 2015); Co-chair: Dr David Mercier
- Special Issue on "Effective Feature Fusion in Deep Neural Networks", IEEE Transactions on Neural Networks and Learning Systems (upcoming); Co-editors: Yanwei Pang (Tianjin University), Fahad Shahbaz Khan (Inception Institute of Artificial Intelligence, UAE), Xin Lu (Adobe)
- Research Topic on "Theory of mind in humans and in machines", Frontiers in Artificial Intelligence; Co-editors: Barbara J. Sahakian (Cambridge University) and Bogdan-Ionut Cirstea (Oxford Brookes)
- MIDL 2020 Challenge: "SARAS endoscopic vision challenge for surgeon action detection (SARAS-ESAD 2020)" <https://saras-esad.grand-challenge.org/>

In addition, I am now working towards the submission of various **Workshop and Challenges** proposals:

- *Continual semi-supervised learning*, to submit to IJCAI 2021, Feb 5 2021
- *Multi-domain Endoscopic Surgeon Action Detection*, submitted to MICCAI 2021, Dec 10 2021
- *Situation awareness in autonomous driving: the ROAD challenge*, to submit to ICCV 2021, Feb 27 2021

Media and public engagement

- Article: Walk this way, "International Innovation", a Research Media magazine, January 2014
- UAI 2015 tutorial: <https://www.youtube.com/watch?v=nhGznOR5TgM> (2,988 views on YouTube)
- "Towards machines that can read your mind", Professorial Lecture, Jan 24 2018
<https://www.facebook.com/oxfordbrookes/videos/10156698398637908/> (3,449 views on Facebook)
- Harvard Statistics colloquia invited talk: Belief functions: past, present and future, July 14 2016
<https://www.youtube.com/watch?v=l9XKJKgkURQ> (2,359 views on YouTube)
- Risk Group LLC: invited podcast on "Advances in Artificial Intelligence: Gesture and Action Recognition"
<https://www.youtube.com/watch?v=xWrUwJAYqA0&t=1258s> (237 views)
- "The 3,600 mile experiment: Parkinson's disease on the ocean" – MedicalXpress, June 25 2018
- "Row for Parkinson's" – The West Australian, 7 July 2018
- "British Crew Rowing the Distance to Improve Understanding of Parkinson's Disease", Parkinson's News Today, June 27 2018
- Venturefest Oxford: <https://venturefestoxford.com/experts/the-crucial-role-of-theory-of-mind-tom-capabilities-in-developing-a-next-generation-human-centric-artificial-intelligence/>
- SARAS Challenge – Best of MIDL 2020, Computer Vision News, August 2020
<https://rsipvision.com/ComputerVisionNews-2020August/16/>

4 Teaching

I have an **extensive teaching experience at university level in three different countries**, first as a Teaching Assistant (TA) in Padua and Milan, Italy, later as a TA at the University of California at Los Angeles, USA, and eventually as the Module Leader for a number of Undergraduate and Postgraduate courses at Oxford Brookes University, UK. At Brookes I have supervised several Master's students' dissertations and third year's final projects, and **I regularly mentor a number of undergraduate students as their Academic Adviser**.

Taught courses at PG level: P00990 "Research and Scholarship Methods" (2013-14), P00405 "Mathematical Methods for Computer Vision" (2013-17), P00406 "Machine Learning" (2013-18), P00408 "Advanced Computer Vision" (2015-17), "Advanced Machine Learning" (2018-now), "Data Science and Machine Learning" (2019-now), all as the Module leader, plus P00702 "Cyber security and the web" and P00407 "Principles of Computer Vision" as co-teacher. **At UG level:** U08781 "Machine Vision" (2008-2021), U08280 "Advanced Artificial Intelligence" (2009-2013), U08884 "Image Technology" (2009-2015) as the Module Leader, plus U08027 "Current research", U08702 "Multimedia IT skills" and U08055 "Professional issues and computer risks" as co-teacher.

As the **Subject Coordinator of the MSc in Computer Vision** (2014-2018) I was responsible for embedding the Course within the research activities of the Visual AI Lab. I directly designed the four core modules of the course when it was validated, around a number of pillars: an introduction to the Mathematical Methods for Computer Vision (P00405), an introduction to the main Principles of Computer Vision (P00407), a module dedicated to Machine Learning (P00406) and an Advanced Computer Vision module structured as a series of four seminars centred around a number of real-world application scenarios. The Course was designed to forge links between the taught programme and the research group, enabling MSc students to produce research papers and feel part of the group's research efforts. My research work feeds into the content of the UG module U08781 Machine Vision, as well as the new P08820 Introduction to Machine Learning and P08821 Advanced Machine Learning modules of the **MSc in Data Analytics** course (2018-now).

5 Publications

Contribution to REF 2014 and REF 2021

My papers have given a major contribution to the Department of Computing's REF 2014 results. In all mock panels run before submission, **they have consistently scored 4*** (consider that 18% outputs have eventually been judged 4*, and only 9 members of staff submitted):

- A geometric approach to the theory of evidence 4*
- Geometry of relative plausibility and relative belief of singletons 4*
- Credal semantics of Bayesian transformations in terms of probability intervals 4*

- The geometry of consonant belief functions: simplicial complexes of necessity measures 4*

In initial REF2021 internal reviews, **all my papers were judged 4*** (only case in the Computing UoA).

For REF2021 I am **also leading an Impact Case Study** entitled “Societal and economic impact of AI for human behaviour understanding”, one of only 2 ICSS UoA11 (Computing) is preparing for submission.

Metrics

My **Google Scholar** citations (11/01/2021) have doubled in 4 years, and are currently **up by some 20% a year**.

- Total count: **1,980 (+281 in 2020)**

• H-index: 20. i10-index: 45.

Google Scholar profile: <https://scholar.google.co.uk/citations?user=T8LkBTYAAAAJ&hl=en>

Top papers by Scholar citation count:

1. Articulated shape matching using Laplacian eigenfunctions & unsupervised point registration (2008)	223
2. A geometric approach to the theory of evidence (2008)	172
3. Online real-time multiple spatiotemporal action localisation and prediction (2017)	170
4. Deep learning for detecting multiple space-time action tubes in videos (2016)	148
5. Learning discriminative space-time action parts from weakly labelled videos (2014)	114

Top papers by citation increase in 2020:

1. Online real-time multiple spatiotemporal action localisation and prediction (2017)	+52
2. Evidence combination based on credal belief redistribution for pattern classification (2019)	+43
3. Deep learning for detecting multiple space-time action tubes in videos (2016)	+36
4. Untrimmed video classification for activity detection: submission to ActivityNet challenge (2016)	+20
5. AMTnet: Action micro-tube regression by end-to-end trainable deep architecture (2017)	+14
6. Metric learning for Parkinsonian identification from IMU gait measurements (2017)	+11
7. Robust classification of multivariate time series by imprecise hidden Markov models (2015)	+11

List of Publications

Most of my articles are on **very high impact journals (IEEE TFS, PAMI, IJCV, IEEE SMCB)**. The **total impact factor of my journal papers as of November 2020 is circa 110**. In almost all my publications I am either first author (first material contributor to the work) or last author (as supervisor and more generally director of the research). In all other cases I contributed fairly as a team member.

Monographs & Edited Volumes

1. F. Cuzzolin, *The geometry of uncertainty - The geometry of imprecise probabilities*, Artificial Intelligence: Foundations, Theory, and Algorithms, Springer International Publishing, January 2021; ISBN 978-3-030-63152-9, DOI 10.1007/978-3-030-63153-6
2. S. Destercke, T. Denoeux, F. Cuzzolin, A. Martin (Editors), *Belief Functions: Theory and Applications – Proceedings of BELIEF 2018*, LNCS 11069, Springer, 2018 – DOI 10.1007/978-3-319-99383-6
3. F. Cuzzolin, *Visions of a generalised probability theory*, Lambert Academic Publishing, September 24, 2014 ISBN-13: 978-3-659-13175-2
4. F. Cuzzolin (Editor), *Belief Functions: Theory and Applications*, Lecture Notes in Artificial Intelligence (LNCS), Volume 8764, Springer International Publishing, 2014 – DOI 10.1007/978-3-319-11191-9

Book Chapters

5. Suman Saha, Gurkirt Singh, Michael Sapienza, Philip H. S. Torr and Fabio Cuzzolin, *Spatio-Temporal Action Instance Segmentation and Localisation*, In “Modelling Human Motion”, 141-161, July 2020
6. F. Cuzzolin, *An algebraic study of the notion of independence of frames*, Chapter 12, “Mathematics of Uncertainty Modeling in the Analysis of Engineering and Science Problems”, IGI Publishing, January 2014
7. F. Cuzzolin, *Manifold learning for multi-dimensional auto-regressive dynamical models*, in “Machine Learning for Vision-based Motion Analysis”, Advances in Pattern Recognition 1, 55-74, Springer, 2011
8. F. Cuzzolin, *Multilinear modeling for robust identity recognition from gait*, in “Behavioral Biometrics for Human Identification: Intelligent Applications”, 169-188, Liang Wang and Xin Geng (Eds.), IGI, 2010

Journal papers*Published or accepted*

9. Wojtek Buczynski, Fabio Cuzzolin and Barbara J. Sahakian, *Machine Learning in equity investment decision-making*, Journal of Data Science and Analytics, accepted Jan 2021
 10. A. Leporini et al., *Technical and Functional Validation of a Teleoperated Multirobots Platform for Minimally Invasive Surgery*, IEEE Transactions on Medical Robotics and Bionics, Print ISSN: 2576-3202, Online ISSN: 2576-3202, Digital Object Identifier: 10.1109/TMRB.2020.2990286
 11. F. Cuzzolin, A. Morelli, B. Cirstea and B. J. Sahakian, *Knowing Me, Knowing You: Theory of Mind in AI*, Psychological Medicine 50(7), pp. 1057-1061, May 2020, DOI: 10.1017/S0033291720000835 (I.F. 5.641)
 12. Z. Liu, Y. Liu, J. Dezert and F. Cuzzolin, *Evidence Combination Based on Credal Belief Redistribution for Pattern Classification*, IEEE Fuzzy Systems 2019 (in press), 10.1109/TFUZZ.2019.2911915 (IF 8.415)
 13. W. Gong & F. Cuzzolin, *A belief-theoretical approach to example-based pose estimation*, IEEE Fuzzy Systems 26(2):598-611, April 2018, DOI: 10.1109/TFUZZ.2017.2686803 (IF 8.415)
 14. R. de Rosa, I. Gori, N. Cesa-Bianchi & F. Cuzzolin, *Active Incremental Recognition of Human Activities in a Streaming Context*, Pattern Recognition Letters 99, pp. 48-56, November 2017 (IF 1.952)
 15. F. Cuzzolin, M. Sapienza, P. Esser, H. Dawes, S. Saha, J. Collett and M. Franssen, *Metric learning for Parkinsonian identification from IMU gait measurements*, Gait & Posture 54:127-132, May 2017 (IF 2.273)
 16. G. Mellema & F. Cuzzolin, *ISIF Sponsored Workshop - BELIEF 2014*, ISIF Perspectives on Inf. Fusion, 2016
 17. F. Cuzzolin, *Belief functions: Theory and applications (BELIEF 2014)*, International Journal of Approximate Reasoning (I.F. 1.766), 2016.
 18. F. Cuzzolin, D. Mateus and R. Horaud, *Robust coherent Laplacian protrusion segmentation along 3D sequences*, International Journal on Computer Vision 112(1):43-70, March 2015 (I.F. 11.541)
 19. A. Antonucci, R. de Rosa, A. Giusti and F. Cuzzolin, *Robust Classification of Multivariate Time Series by Imprecise Hidden Markov Models*, Int. J. of Approximate Reasoning 56:249-263, January 2015 (I.F. 1.766)
 20. M. Sapienza, F. Cuzzolin & P. Torr, *Learning discriminative space-time action parts from weakly labelled videos*, International Journal of Computer Vision 110(1):30-47, Oct 2014 (I.F. 11.541)
 21. F. Cuzzolin and M. Sapienza, *Learning pullback HMM distances*, IEEE Transactions on Pattern Analysis and Machine Intelligence 36(7):1483-1489, July 2014 (I.F. 9.455)
 22. F. Cuzzolin, *On the fiber bundle structure of the space of belief functions*, Ann. Comb. 18(2):245-263, 2014
 23. F. Cuzzolin, *Lp consonant approximations of belief functions*, IEEE Transactions on Fuzzy Systems 22(2):420-436, April 2014 (I.F. 8.415)
 24. F. Cuzzolin, *On the relative belief transform*, International Journal of Approximate Reasoning 53(5):786-804, July 2012 (I.F. 1.766)
 25. A. Ozonoff, F. Cuzzolin and P. Snow, *Guest editorial: Special issue on information fusion applications to human health and safety*, Information Fusion 13(2), April 2012 (I.F. 6.639)
 26. F. Cuzzolin, *Three alternative combinatorial formulations of the theory of evidence*, Intelligent Data Analysis 14(4):439-464, Dec 2010 (best paper award at PRICAI'08) (I.F. 0.691)
 27. F. Cuzzolin, *Geometry of relative plausibility and relative belief of singletons*, Annals of Mathematics and Artificial Intelligence 59(1):47-79, May 2010 (I.F. 0.899)
 28. F. Cuzzolin, *The geometry of consonant belief functions: simplicial complexes of necessity measures*, Fuzzy Sets and Systems 161(10):1459-1479, 16 May 2010 (I.F. 2.675)
 29. F. Cuzzolin, *Credal semantics of Bayesian transformations in terms of probability intervals*, IEEE Transaction on Systems, Man, and Cybernetics - part B 40(2):421-432, 2010 (I.F. 6.22)
 30. F. Cuzzolin, *A geometric approach to the theory of evidence*, IEEE Transactions on Systems, Man, and Cybernetics - part C 38(4):522-534, 2008 (I.F. 2.171)
 31. F. Cuzzolin, *Two new Bayesian approximations of belief functions based on convex geometry*, IEEE Transactions on Systems, Man, and Cybernetics - part B 37(4):993-1008, 2007 (I.F. 6.22)
 32. F. Cuzzolin, *Algebraic structure of the families of compatible frames of discernment*, Annals of Mathematics and Artificial Intelligence 45(1-2):241-274, 2005 (I.F. 0.899)
 33. F. Cuzzolin, *Geometry of Dempster's rule of combination*, IEEE Transactions on Systems, Man, and Cybernetics - part B 34(2):961- 977, 2004 (I.F. 6.22)
- Under review or revision*
34. Andrea Morelli, Barbara J. Sahakian and Fabio Cuzzolin, *From psychology and neuroscience to AI: toward a learning-based computational Theory of Mind model*, submitted to Frontiers in Systems Neuroscience (IF 3.928), April 7 2020

35. Fath U Min Ullah, Mohammad Obaidat, Khan Muhammad, Amin Ullah, Sung Baik, Fabio Cuzzolin and Victor Albuquerque, *Intelligent Violence Pattern Analysis and Detection using Residual Optical Flow CNN Features and Stacked LSTM*, submitted to the IEEE Transaction on Pattern Analysis and Machine Intelligence, August 2020 (**I.F. 9.455**)

In preparation

- V. Singh et al., *The SARAS surgical action detection challenge*, to submit to Medical Image Analysis (**IF 8.88**), Jan 2021
- G. Singh et al., *ROAD: The ROad event Awareness Dataset for Autonomous Driving*, IEEE Transaction on Pattern Analysis and Machine Intelligence, Jan 2021 (**I.F. 9.455**)
- G. Singh and F. Cuzzolin, *Recurrent Convolutional Networks for Causal Action Recognition and Detection*, to submit to IEEE Transaction on Pattern Analysis and Machine Intelligence, Jan 2021 (**I.F. 9.455**)
- G. De Rossi, N. Piccinelli, F. Cuzzolin and R. Muradore, *Efficient Time-Interpolated Convolutional Network for Fine-Grained Action Segmentation*, to submit to IEEE Transactions on Medical Robotics and Bionics Journal (T-MRB), 2021
- F. Cuzzolin, K. Cannons, M. Hossain and Z. Xu, *Continual semi-supervised learning*, to submit to IEEE Transaction on Pattern Analysis and Machine Intelligence, Feb 2021 (**I.F. 9.455**)
- B. Cirstea, C. Langley, F. Cuzzolin and B. J. Sahakian, *Theory of mind in humans and in machines: A survey*, to submit to Frontiers in Artificial Intelligence, April 2021
- W. Buczynski et al., *What is AI regulation in investment management likely to entail? - emerging regulatory themes for Artificial Intelligence in investment research, investment decision-making, and trading*, to submit in Spring 2021

Chapters in book series

36. Inna Skarga-Bandurova, Rostislav Siriak, Tetiana Biloborodova, Fabio Cuzzolin, Vivek Singh Bawa, Mohamed Ibrahim Mohamed and R. Dinesh Jackson Samuel, Surgical Hand Gesture Prediction for the Operating Room, In "Studies in Health Technology and Informatics", Vol. 273, pp. 97-103, 2020
37. F. Cuzzolin, Complexes of outer consonant approximations, in "Symbolic and Quantitative Approaches to Reasoning with Uncertainty", Lecture Notes in Computer Science, Vol. 5590/2009, pp. 275-286
38. F. Cuzzolin, The intersection probability and its properties, in "Symbolic and Quantitative Approaches to Reasoning with Uncertainty" (ECSQARU'09), LNCS Vol. 5590/2009, pp. 287-298, Springer, 2009
39. F. Cuzzolin, Alternative formulations of the theory of evidence based on basic plausibility and commonality assignments (**long paper, best paper award recipient**), in "PRICAI 2008: Trends in Artificial Intelligence", Lecture Notes in Computer Science, Vol. 5351/2008, pp. 91-102, Springer, 2009
40. F. Cuzzolin, Dual properties of the relative belief of singletons (**long paper**), in "PRICAI 2008: Trends in Artificial Intelligence", LNCS Vol. 5351/2008, pp. 78-90, Springer Berlin/Heidelberg, 2009
41. F. Cuzzolin, On the credal structure of consistent probabilities, in "Logics in Artificial Intelligence", Lecture Notes in Computer Science, Volume 5293/2008, pp. 126-139, Springer Berlin / Heidelberg, 2008
42. F. Cuzzolin, A lattice-theoretic interpretation of independence on frames, in "Interval/ Probabilistic Uncertainty and Non-classical Logics", Advances in Soft Computing, Vol. 46, Springer-Verlag, 2008
43. F. Cuzzolin, Semantics of the relative belief of singletons, in "Interval/Probabilistic Uncertainty and Nonclassical Logics", Advances in Soft Computing, Vol. 46, Springer-Verlag, Berlin - Heidelberg, 2008
44. F. Cuzzolin, D. Mateus, E. Boyer & R. Horaud, Robust spectral 3D-bodypart segmentation in time, Lecture Notes in Computer Science, Vol. 4814/2007, pp. 196-211, Springer, 2007
45. F. Cuzzolin, On the orthogonal projection of a belief function, in "Symbolic and Quantitative Approaches to Reasoning with Uncertainty", LNCS Vol. 4724/2007, pp. 356-367, Springer, 2007

Peer-reviewed conference proceedings (in reverse chronological order)

46. M. Hossain, K. Cannon, D. Jang, F. Cuzzolin and Z. Xu, Video-based crowd counting using a multi-scale optical flow pyramid network, Proceedings of ACCV 2020
47. O. Gune, B. Banerjee and F. Cuzzolin, Generalized zero-shot learning using generated proxy unseen samples and entropy separation, Proceedings of ACM Multimedia 2020, July 2020
48. N. Bhargava and F. Cuzzolin, Challenges and Opportunities for Computer Vision in Real-life Soccer Analytics, AAAI 2020 Workshop on AI in Team Sports (AITS 2020), Feb 2020
49. G. Singh and F. Cuzzolin, Recurrent Convolutions for Causal 3D CNNs, ICCV 2019, First International Workshop on Holistic Video Understanding, Seoul, South Korea, October 2019
50. S. Olivastri, G. Singh, F. Cuzzolin, End-to-End Video Captioning, ICCV 2019, First International Workshop on Holistic Video Understanding, Seoul, South Korea, October 2019

51. G. De Rossi, F. Setti, R. Muradore and F. Cuzzolin, Surgical Action Recognition with Spatiotemporal Convolutional Neural Networks, Proceedings of the Hamlyn Symposium on Medical Robotics (HSMR19)
52. H. Zhou, I. Bayley, R. Harrison and F. Cuzzolin, Datamorphic Testing: A Method for Testing Intelligent Applications, Proceedings of IEEE AI Testing, Feb 2019
53. S. Saha, G. Singh & F. Cuzzolin, TraMNet - Transition matrix network for high-performance spatio-temporal action localisation, Proceedings of ACCV 2018, December 2018
54. G. Singh, S. Saha and F. Cuzzolin, Predicting action tubes, ECCV 2018 Workshop on Anticipating Human Behaviour (AHB 2018), September 2018 (**oral**)
55. H. Behl, M. Sapienza, G. Singh, S. Saha, F. Cuzzolin, P. Torr, Incremental tube construction for human action detection, Proc. of BMVC 2018 (**oral**)
56. F. Cuzzolin, Generalised maximum entropy classifiers, Proc. of BELIEF 2018 (**oral**)
57. F. Cuzzolin, General geometry of belief function combination, Proc. of BELIEF 2018 (**oral**)
58. G. Singh, S. Saha, M. Sapienza, P. Torr & F. Cuzzolin, Online real-time multiple spatiotemporal action localisation and prediction, Proc. of ICCV 2017, Venice, Italy, October 2017 (**poster, acceptance rate 25%**)
59. S. Saha, G. Singh & F. Cuzzolin, AMTnet: Action micro-tube regression by end-to-end trainable deep architecture, Proc. of ICCV 2017, Venice, Italy, October 2017 (**poster, acceptance rate 25%**)
60. C. Zhou and F. Cuzzolin, The total belief theorem, Proc. of Uncertainty in Artificial Intelligence (UAI), 2017
61. S. Saha, G. Singh, M. Sapienza, P. Torr and F. Cuzzolin, Deep learning for detecting multiple space-time action tubes in videos, Proc. of BMVC 2016 (**poster**)
62. C. Roman, M. Sapienza, P. Ball, S. Ou, F. Cuzzolin and P. Torr, Heterogeneous wireless system testbed for remote image processing in automated vehicles, Proc. of IEEE CSNDSP 2016
63. S. Jetley and F. Cuzzolin, 3D activity recognition using gradient analysis consolidated over motion history and binary shape templates, Proc. of the Asian Conference of Computer Vision (ACCV 2014) - Human Gait and Action Analysis in the Wild: Challenges and Applications workshop, Singapore, Nov 2014
64. R. de Rosa, I. Gori, N. Cesa Bianchi and F. Cuzzolin, Online action recognition via nonparametric incremental learning, Proc. of the British Machine Vision Conference (BMVC'14), 2014
65. W. Gong, M. Sapienza and F. Cuzzolin, Fisher tensor decomposition for unconstrained gait identification, ECML-PKDD Workshop on "Tensor Methods for Machine Learning", July 2013
66. F. Cuzzolin and W. Gong, Belief modeling regression for pose estimation, Proceedings of the 16th IEEE International Conference on Information Fusion (FUSION'13), pp. 1398-1405, Istanbul, July 2013
67. R. de Rosa, A. Antonucci, A. Giusti and F. Cuzzolin, Classification of temporal data by imprecise dynamic models, International Symposium on Imprecise Probabilities (ISIPTA 2013), Compiègne, France, July 2013
68. M. Sapienza, F. Cuzzolin and P. Torr, Learning discriminative space-time actions from weakly labelled videos, Proc. of BMVC'12, University of Sussex, September 2012 (**oral, shortlisted for major prizes**)
69. F. Cuzzolin, Consonant approximations in the belief space, Proc. of the 2nd International Conference on Belief Functions (BELIEF'12), Compiègne, France (**oral**)
70. F. Cuzzolin, Generalizations of the relative belief transform, Proc. of the 2nd International Conference on Belief Functions (BELIEF'12), Compiègne, France (**oral**)
71. F. Cuzzolin, Game-theoretical semantics of epistemic probability transformations, Proc. of the 2nd International Conference on Belief Functions (BELIEF'12), Compiègne (**oral**)
72. F. Cuzzolin, Lp consonant approximations of belief functions in the mass space, Proceedings of ISIPTA'11, Innsbruck, June 2011 (**shortlisted for best paper based on review scores**)
73. F. Cuzzolin, On consistent approximations of belief functions in the mass space, Proc of ECSQARU, 2011
74. A. Antonucci and F. Cuzzolin, Credal sets approximation by lower probabilities: Application to credal networks, Proc. of the Int Conf on Information Processing and Management of Uncertainty (IPMU'10)
75. F. Cuzzolin, Geometric conditioning of belief functions, the First International Workshop on the Theory of Belief Functions (BELIEF 2010), Brest, April 2010
76. T. Burger and F. Cuzzolin, The barycenters of the k-additive dominating belief functions and the pignistic k-additive belief functions, BELIEF 2010, Brest, April 2010
77. F. Cuzzolin, Consistent approximations of belief functions, Proceedings of the International Symposium on Imprecise Probabilities and Their Applications (ISIPTA'09), Durham, July 2009
78. F. Cuzzolin, Credal semantics of Bayesian approximations, Proc. of ISIPTA'09, Durham, UK, July 2009
79. F. Cuzzolin, Learning pullback metrics for linear models, European Conference on Computer Vision (ECCV'08), First workshop on Machine Learning for Vision-based Motion Analysis, October 2008

80. D. Mateus, R. Horaud, D. Knossow, F. Cuzzolin, and E. Boyer, Articulated shape matching using Laplacian eigenfunctions and unsupervised point registration, Proc. of Computer Vision and Pattern Recognition (CVPR'08), Anchorage, Alaska, June 2008 (**acceptance rate 25%**)
 81. F. Cuzzolin, D. Mateus, D. Knossow, E. Boyer and R. Horaud, Coherent Laplacian protrusion segmentation, Proceedings of CVPR'08, Anchorage, June 2008 (**acceptance rate 25%**)
 82. F. Cuzzolin, Boolean and matroidal independence in uncertainty theory, Proc. of the 10th International Symposium on Mathematics and Artificial Intelligence (ISAIM'08), Fort Lauderdale, January 2008
 83. F. Cuzzolin, An interpretation of consistent belief functions in terms of simplicial complexes, Proceedings of ISAIM'08, Fort Lauderdale, Florida, January 2008
 84. D. Mateus, F. Cuzzolin, E. Boyer and R. Horaud, Articulated shape matching by robust alignment of their embedded representations, International Conference on Computer Vision - 3dRR Workshop, 2007
 85. D. Mateus, F. Cuzzolin, E. Boyer and R. Horaud, Articulated shape matching using Locally Linear Embedding and orthogonal alignment, ICCV'07 - NTRL Workshop, Rio de Janeiro, October 14 2007
 86. F. Cuzzolin, Using bilinear models for view-invariant action and identity recognition, Proc. of Computer Vision and Pattern Recognition (CVPR'06), pp. 1701-1708, New York, June 2006
 87. F. Cuzzolin, The geometry of relative plausibilities, Proceedings of IPMU'06, Paris, July 2006
 88. F. Cuzzolin, On the properties of relative plausibilities, Proceedings of the International Conference of the IEEE Systems, Man, and Cybernetics Society (SMC'05), vol.1, pp. 594-599, Hawaii, USA - October 2005
 89. F. Cuzzolin and R. Frezza, Evidential modeling for pose estimation, Proc. of ISIPTA'05, Pittsburgh, 2005
 90. G. Gennari, A. Chiuso, F. Cuzzolin and R. Frezza, Integration of shape constraints in data association filters, Proc. of IEEE CDC'04, vol.3, pp. 2668-2673, December 14-17, 2004
 91. F. Cuzzolin, A. Sarti and S. Tubaro, Action modeling with volumetric data, Proc. of the 2004 International Conference on Image Processing (ICIP'04), vol. 2, pp. 881- 884, Singapore, October 2004
 92. F. Cuzzolin, A. Sarti and S. Tubaro, Invariant action classification with volumetric data, International Workshop on Multimedia Signal Processing, pp. 395-398, Siena, Italy, 9/29-10/1 2004
 93. F. Cuzzolin, Simplicial complexes of finite fuzzy sets, Proceedings of the International Conference on Information Processing and Management of Uncertainty (IPMU'04), pp. 1733-1740, Perugia, July 2004
 94. F. Cuzzolin, Geometry of upper probabilities, Proceedings of ISIPTA'03, Lugano, July 14-17, 2003
 95. F. Cuzzolin, R. Frezza, A. Bissacco and S. Soatto, Towards unsupervised detection of actions in clutter, Proc. of the 2002 Asilomar Conference on Signals, Systems, and Computers, vol.1, pp. 463-467, 2002
 96. G. Gennari, A. Chiuso, F. Cuzzolin and R. Frezza, Integrating shape and dynamic probabilistic models for data association and tracking, Proceedings of the IEEE Conference on Decision and Control, 2002
 97. F. Cuzzolin, Geometry of Dempster's rule, Proceedings of the International Conference on Fuzzy Systems and Knowledge Discovery (FSKD'02), Singapore, November 18-22, 2002
 98. F. Cuzzolin and R. Frezza, Lattice structure of the families of compatible frames of discernment, Proceedings of ISIPTA'01, Ithaca, NY, June 26-29, 2001
 99. F. Cuzzolin and R. Frezza, Geometric analysis of belief space and conditional subspaces, Proceedings of ISIPTA'01, Ithaca, NY, June 26-29, 2001
 100. R. Cuzzolin and R. Frezza, Integrating feature spaces for object tracking, Proc. of the International Symposium on the Mathematical Theory of Networks and Systems (MTNS), Perpignan, June 2000
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6 Funding

Awarded Grants

Date	Funder/Scheme	Project Title	Amount	Own share	Own Role	Notes
Dec 2008	Brookes CRF	Uncertainty in computer vision	£3,000	N/A	PI	
Jan 2011	Oxford Brookes – Int. Transport Systems DTP	Recognising and localising human actions	PhD Studentship	N/A	PI/Director of Studies	
Feb 2011	EPSRC – First Grant scheme	Tensorial modeling of dynamical systems for gait and activity recognition	£122,000	£122,000	PI	Jul 2011 - Jan 2014
Oct 2012	Brookes - TDE	Next 10 Award	PhD Studentship	N/A	PI/Director of Studies	Sep 2014 – Oct 2017
2014	Onera, Elsevier, ISIF, TDE	Sponsorship of BELIEF 2014	£7,000	N/A	Program Chair	
July 2014	Brookes 150th Anniversary	Online action recognition for HRI	PhD Studentship	N/A	PI/Director of Studies	Sep 2015 -Mar 2019
April 2015	Innovate UK	Meta Vision LTD KTP	£160,000	£160,000	Academic Supervisor	Sep 2015 - Aug 2017
Oct 2015	NVIDIA	Hardware Grant Request	£650	£650	N/A	one Titan X GPU card
Jan 2017	Brookes - IIT Bombay exchange	Action detection and recognition from videos	£3,500	N/A	Supervisor	One visiting student for 12 weeks
Nov 2017	Brookes - IIT Bombay exchange	Deep-predicting future actions	£3,500	N/A	Supervisor	One visiting student for 10 weeks
Aug 2017	European Union - Horizon 2020, Call ICT-27-2017	SARAS - Smart Autonomous Robotic Assistant Surgeon	€4,315,640	€596,073	WP Leader & Scientific Officer	Jan 18 - Dec 20 Coordinator Verona
Aug 2018	Innovate UK	Createc/Sportlight KTP	£190,000	£190,000	PI, Lead Academic	
Aug 2018	Brookes ECM School	AI for autonomous driving	£100,000	£100,000	PI	2-year Fellow
June 2019	Huawei Technologies	Video analysis and activity recognition	£278,000	£278,000	PI	1 postdoc, 1 studentship
April 2019	UKIERI	Analysis of human actions in unconstrained videos	£48,076	£24,807	PI	Co-PI is Prof Chaudhuri, IIT Bombay
July 2019	Leverhulme Trust Research Project Grants	Theory of mind at the interface of neuroscience & AI	£273,000	£138,000	PI	Co-I Prof Sahakian, Cambridge

July 2019	Research England Development	Oxford Brookes AI & Data Analysis Incubator (AIDA)	£1,257,000 +£654,000 co-funding	£1,257,000	Advisor, lead team member	PI Prof Nigel Crook
Oct 2020	FETOPEN-01-2018-2020	Epistemic AI	€3,016,618	€1,207,795	Coordinator	With KU Leuven, Delft
Jan 2020	Innovate UK	KTP with Supponor	£310,792	£310,792	Lead academic	Co-I Alex Rast

Pending bids

Date	Funder	Project title	Amount	Share	Role	Notes
2020	Venture capital, private investors	Olympia	£5M	£5M	Co-founder, CTO	Startup
Nov 2019	Leonardo	Object detection from aerial images	£96,000	£96,000	PI	
Oct 14 2020	EPSRC Transformative Healthcare	MAESTRO Jr - Multi-sensing AI Environment for Surgical Task & Role Optimisation	£300K	£140K	Co-I	PI George Mylonas, Imperial; Full proposal invited
Nov 25 2020	Innovate UK Smart Grants	Safe Healthy Workplace Performance: a double-impact technology solution and research project delivering national recovery & business transformation	£2M	£460K	Brookes PI	Led by Peoplespace Ltd
Nov 25 2020	Innovate UK Smart Grants	An AI-powered Algorithm that Enables More Accurate Scan Diagnoses at a 95% Faster Rate	£500K	£157K	Brookes PI	Led by Converz Ltd

Proposals in preparation (with expected submission date)

Date	Funder	Project title	Value	Share	Role	Notes
2021	Leverhulme Trust	Uncertainty in reinforcement learning	£250K	£125K	Co-I	Led by Dr Matthias Rolf
2021	EPSRC Healthcare Technologies	Understanding the cognitively impaired using a machine theory of mind	£1.5M	£1.5M	PI	Co-Is Helen Dawes and Derick Wade
2021	EPSRC Responsive mode	Epistemic AI for autonomous driving	£1.3M	£1.3M	PI	Co-I Andrew Bradley
2021	TBD	Epistemic modelling of pandemics	TBD	TBD	PI	Co-I Dr Edlefsen, Fred Hutchinson Cancer Research
2021	Horizon Europe	MAESTRO - Multi-sensing AI Environment for Surgical Task & Role Optimisation	€10M	TBD	WPL	Led by Dr George Mylonas, Imperial College London, resub of 2020 bid
2021	Horizon Europe	SARAS++	€4-5M	TBD	WPL	Led by University of Verona – Follow-up from SARAS project
2021	Horizon Europe	Continual AI (tentative)	TBD	TBD	Coordinator	With University of Bologna, Italy

7 Enterprise and Knowledge Exchange

Knowledge Transfer Partnerships & Innovate UK

I was Academic Supervisor for a £160,000 **KTP with Meta Vision LTD**, an Oxford company (originally a spinoff of Oxford University) which has as clients very large companies active in the aerospace industry (Ariane), oil industry, on laser inspection of industrial welding. The project aimed to automatically localise and recognise various types of weld defects from 3D reconstructions of the surfaces involved using advanced machine learning. In August 2018 I was awarded, as Lead Academic and Academic Supervisor, a second £190,000 **KTP in partnership with Createc** (<https://www.createc.co.uk/>) and **Sportlight Technology** (<http://www.sportlight.ai>), another Oxford University spinoff whose core business is the analysis of sports footage to the benefit of professional franchises, as well the monitoring of crowds for surveillance purposes. The project involves the fusion of LiDAR and video data in a rather original and challenging setting, and has contributed to the Impact Case Study led by me. As recently as Jan 2021 I was awarded a **new KTP with Supponor** a company leader in virtual advertisement on signage around the pitch in professional football matches (but also other professional sports such as baseball and American football, <https://www.supponor.com>). A £2M Innovate UK project (ZEBRA) is pending on the safe monitoring of workspaces in the pandemic, led by **Peoplespace Ltd**, to which we are contributing the AI module and our expertise on understanding human behaviour from videos. Another Innovate UK Smart Grants application on the application of federated learning to the diagnosis of x-ray images is pending, led by Converz. Converz is a local company whose CEO (Dev Bharti) is a part-time PhD student with me. Discussions on an additional potential KTP with Impair.ai on car purchase recommendations are also ongoing. In partnership with **Anyvision** (www.anyvision.co), the leading startup in the field of visual recognition, I am negotiating another Innovate UK project on Digital Technologies for Healthcare. Together with Head of Research Eduard Vazquez we are also exploring a range of potential collaborations in other areas. Finally, I am discussing an Innovate UK bid with **Hummingbirds Technologies** (Panagiotis Sidiropoulos, Head of Innovation), see <https://hummingbirdtech.com/>.

Partnerships and links with national and international companies

In 2018 I established strong links with **Huawei Technologies** through their **Hisiicon** division based in Vancouver, Canada. As a result, I took on as of September 2018 the role of Executive Committee member of the newly created joint Huawei – Simon Fraser University research centre for 20% of my time. In conjunction Huawei has awarded my team research funding for an initial amount of £278,000 for a three-year project on complex activity recognition, covering a postdoc for 2 years and a PhD student.

A new startup company called **Olympia.ai** (CEO Pascal Pert) is being set up around the core action detection technologies developed in my Lab. At this stage we are close to finalising a seed £5M funding for the project, which aims at creating and commercialising the world's first AI coach for taekwondo. **AI Labs**, Bologna, have funded a visitor (Silvio Olivastri) in 2018-19 as a first step towards a permanent collaboration. Two of my PhD students have won internships at **Disney Research** in Zurich and Carnegie Mellon. Another PhD student, Gurkirt Singh, was an intern at **Borealis AI** (<https://www.borealisai.com/>), the Canadian start-up funded by Royal Bank of Canada with Prof Greg Mori as Research Director, before joining ETH Zurich as a postdoc.

Our work has recently attracted interest from **Intuitive Inc.** (<https://www.intuitive.com/>, the world's dominant force in surgical robotics), in particular in relation to the SARAS Horizon 2020 project, and **Leonardo** (www.uk.leonardocompany.com/), the defence and technology multinational. A research agreement with Leonardo is currently on hold, as they are waiting for funding available in 2021.

In addition, I have longstanding connections with **Google**, in the persons of Rahul Sukthankar, Vittorio Ferrari and Carl Vondrick, as well as the **DeepMind** division (Prof De Freitas, Dr Francesco Nori). Sukthankar was also part of the steering committee of a recent Leverhulme bid of mine. I have contacts with **Apple Special Projects'** Russ Webb and **Amazon Go's** Gerard Medioni, as well as **Amazon** (UCLA Prof Stefano Soatto and Caltech Prof Pietro Perona) and **Amazon Robotics** (Matt Lyman, director of software; Jeremy Wyatt), their division dealing with automation. Finally, I was recently approached by **Roborace**, **Samsung AI Research** Cambridge and **NVIDIA** for a potential collaboration on autonomous racing cars, neuro-symbolic reasoning and general AI, respectively.

8 Referees

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