Dr Relja Arandjelović

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Professional experience

2019-present **Staff Research Scientist**, *Google DeepMind*

2016-2019 **Senior Research Scientist**, *Google DeepMind*

2014-2016 **Postdoctoral Research Assistant**, *INRIA / École Normale Supérieure*
Member of the WILLOW group

2014 **Postdoctoral Research Assistant**, *University of Oxford*
Member of the Visual Geometry Group, Department of Engineering Science

2013 **Research Assistant**, *University of Oxford*
Member of the Visual Geometry Group, Department of Engineering Science

2013 **Software Engineering Intern**, *Google*, Los Angeles, USA
Member of the Visual Search team

2008 **Undergraduate Researcher**, *Computing Laboratory, University of Cambridge*
Information Fusion for Sketch Recognition

2007, 2006 **Software Engineering Intern**, *Symbian Ltd*, Milton, UK
Member of the Security team developing the Symbian Operating System for smart mobile phones

Education

2009-2013 **DPhil in Engineering Science**, *University of Oxford (College: Christ Church)*
Visual Geometry Group, Department of Engineering Science
Supervised by Prof. Andrew Zisserman

2005-2009 **MEng and BA in Engineering**, *University of Cambridge (College: Trinity)*
Information and Computer Engineering
4^{th} year: Distinction (ranked 9^{th} out of more than 200)

2001-2005 **High School of Mathematics**, Belgrade, Serbia
Grade point average: 5.0 out of 5.0

Selected awards

2023, 2021,2019, 2015, 2013 *Outstanding Reviewer award*, Conference on Computer Vision and Pattern Recognition (CVPR)

2019, 2016, 2021 *Outstanding Reviewer award*, International Conference on Computer Vision (ICCV)

2020 *Top 10% Reviewer*, Neural Information Processing Systems (NeurIPS)

2020, 2014 *Outstanding Reviewer award*, European Conference on Computer Vision (ECCV)

2018 *Best workshop paper*, NeurIPS workshop on Security in Machine Learning

2018 *Best workshop paper*, ECCV workshop on Compact and Efficient Feature Representation and Learning in Computer Vision

2008, 2009 Trinity College, Cambridge awarded the *Tripos* prize and the status of a *Senior Scholar* in recognition of the 3rd and 4th year examination performance

2007 Cambridge University Engineering Department awarded the *1st prize for the Integrated Design Project (IDP)*.
Leader of the software subteam in the project which involved teams of 6 students building an Autonomous Guided Vehicle and competing against each other

2005 Society of Mathematicians of Yugoslavia awarded the *2nd prize at the Federal competition of young programmers*

2003 Society of Mathematicians of Yugoslavia awarded the *2nd prize at the Federal competition of young mathematicians*

Teaching and supervision

2017-present **Lecture at the "Learning from Big Data" Centre for Doctoral Training, University of Oxford**, *"Approximate Nearest Neighbours"*

2016-2021 **Co-supervised Ignacio Rocco Spremolla for MSc and PhD with Josef Sivic. Won the AFRIF (French association for pattern recognition) 2021 PhD Thesis Prize**,
INRIA / École Normale Supérieure

2014-2018 **Co-supervised Yujie Zhong for DPhil with Andrew Zisserman**,
Department of Engineering Science, University of Oxford

2013-2014 **Co-supervised Joon Son Chung for MEng with Andrew Zisserman**,
Department of Engineering Science, University of Oxford
The project was awarded the *GSK Excellence in Communication of Engineering Innovation Award*

2011-2014 **Demonstrator of the Information Engineering laboratory**,
Department of Engineering Science, University of Oxford

2014 **Demonstrator of the Software Engineering laboratory**,
Department of Engineering Science, University of Oxford

Professional activities

Media appearances

2019 DeepMind blog: https://deepmind.com/blog/robust-and-verified-ai/

2018 DeepMind blog: https://deepmind.com/blog/objects-that-sound/

2018 Two minute papers: https://www.youtube.com/watch?v=FMEk8cHF-0A

2017 Two minute papers: https://www.youtube.com/watch?v=mL3CzZcBJZU

2017 Article in the New Scientist:
https://www.newscientist.com/article/2143498-deepmind-ai-teaches-itself-about-the-world-by-watching-videos

2014 Blog post by the BBC Archive:

http://www.bbc.co.uk/informationandarchives/archivenews/2014/face-recognition-and-new-ways-to-search-for-archive.html

2012 Blog posts by Oxford University's Bodleian library:

http://balladsblog.bodleian.ox.ac.uk/blog/570

http://balladsblog.bodleian.ox.ac.uk/blog/174

Thesis defence committees

2019 Samuel Albanie, University of Oxford

2020 Zakaria Laskar, Aalto University

Tutorials at international conferences

2021 "Leave those nets alone: Advances in self-supervised learning" at the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), with S. Gidaris, A. Bursuc, J.-B. Alayrac, A. Recasens, M. Caron, O. Hénaff and A. van den Oord

2020 "Towards Annotation-Efficient Learning: Few-Shot, Self-Supervised, and Incremental Learning Approaches" at the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), with S. Gidaris, K. Alahari and A. Bursuc

Presentations

2022 Talk at Columbia University, "Self-Supervised multimodal learning"

2021 Talk at St Andrews university, "Self-Supervised MultiModal Versatile Networks"

2020 Talk at the Petnica Summer School of Machine Learning, "Leveraging Self-supervision"

2020 Talk at the Pie & AI Belgrade, "Self-supervised Learning"

2019 Talk at the British Machine Vision Association meeting on Geometry and Deep Learning, "Learning to estimate visual correspondence"

2019 Talk at the Pattern Recognition and Computer Vision Colloquium, Center for Machine Perception, CTU Prague, "Objects that Sound"

2018 Talk at "Sight and Sound" CVPR 2018 Workshop, "Look, Listen and Learn"

2018 Talk at the University of Bristol, "Look, Listen and Learn"

2017 Talk at the UCL and Gatsby, "Look, Listen and Learn"

2017 Talk at St Andrews university, "NetVLAD: CNN architecture for weakly supervised place recognition"

2013 Google Tech Talk, "Extremely low bit-rate nearest neighbor search using a Set Compression Tree"

2012 Talk at Oxford University's Bodleian library, "Image Matching on Printed Images in Bodleian Collections"

Deployed systems and demos

2017 Released the VGG Image Search Engine (VISE).

2014 Released a public demo, together with O. M. Parkhi, K. Chatfield and A. Zisserman, in collaboration with BBC R&D, used for visually searching five years of BBC News and Factual footage.

2012 Deployed an image search system to Oxford University's Bodleian library, used for visually searching illustrations of early printed ballad sheets.

2011 Released a public demo for visual search of smooth sculptures, in connection with my ICCV 2011 paper "Smooth Object Retrieval using a Bag of Boundaries".

2011 Deployed an image search system to CLAROS (CLassical Art Research Online Research Services), used for visually searching antique vases and sculptures

Miscellaneous

2009-2014 Administrated three servers and various virtual machines used for hosting public demos for the Visual Geometry Group, University of Oxford.

2012-present Associate editor for Pattern Recognition, area chair for ICCV'23, MVA'21, reviewer for various conferences including CVPR, ICCV, ECCV, ICLR, ACMMM, AAAI, ACCV and BMVC, and journals such as TPAMI, IJCV, Pattern Recognition, Transactions on Image Processing, and Signal Processing Letters. Received the Outstanding Reviewer awards at NeurIPS'20, ECCV'20, ICCV'19, CVPR'19, CVPR'16, ICCV'15, ECCV'14 and ICCV'13.

Skills

Computer skills JAX, TensorFlow, Python, C & C++, Parallel computing (Beam, MapReduce, MPI), MATLAB, etc.

Languages Serbian (native), English (fluent), Italian (intermediate), German (beginner), French (beginner)

Selected publications

2023 "Three ways to improve feature alignment for open vocabulary detection",
Arandjelović, R. and Andonian, A. and Mensch, A. and Hénaff, O. J. and Alayrac, J.-B. and Zisserman, A.
CoRR, abs/2303.13518

2023 "Towards in-context scene understanding",
Balažević, I. and Steiner, D. and Parthasarathy, N. and Arandjelović, R. and Hénaff, O. J.
Neural Information Processing Systems

2022 "Object discovery and representation networks",
Hénaff, O. J. and Koppula, S. and Shelhamer, E. and Zoran, D. and Jaegle, A. and Zisserman, A. and Carreira, J. and Arandjelović, R
European Conference on Computer Vision

2022 "Input-level Inductive Biases for 3D Reconstruction",
Yifan, W. and C. Doersch, C. and Arandjelović, R. and Carreira, J. and Zisserman, A.
IEEE/CVF Conference on Computer Vision and Pattern Recognition

2022 "Hierarchical Perceiver",
Carreira, J. and Koppula, S. and Zoran, D. and Recasens, A. and Ionescu, C. and Hénaff, O. and Shelhamer, E. and Arandjelović, R. and Botvinick, M. and Vinyals, O. and Simonyan, K. and Zisserman, A. and Jaegle, A.
CoRR, abs/2202.10890

2022 "Where should I spend my FLOPS? Efficiency evaluations of visual pre-training methods",
Koppula, S. and Li, Y. and Jaegle, A. and Shelhamer, E. and Parthasarathy, N. and Arandjelović, R. and Carreira, J. and Hénaff, O. J.
NeurIPS workshop on Self-Supervised Learning

2021 "NeRF in detail: Learning to sample for view synthesis",
Arandjelović, R. and Zisserman, A.
CoRR, abs/2106.05264

2020 "Self-Supervised MultiModal Versatile Networks",
Alayrac, J.-B. and Recasens, A. and Schneider, R. and Arandjelović, R. and Ramapuram, J. and De Fauw, J. and Smaira, L. and Dieleman, S. and Zisserman, A.
Neural Information Processing Systems

2020 "Efficient Neighbourhood Consensus Networks via Submanifold Sparse Convolutions",
Rocco, I. and Arandjelović, R. and Sivic, J.
European Conference on Computer Vision

2020 "NCNet: Neighbourhood Consensus Networks for Estimating Image Correspondences",
Rocco, I. and Cimpoi, M. and Arandjelović, R. and Torii, A. and Pajdla, T. and Sivic, J.
IEEE Transactions on Pattern Analysis and Machine Intelligence

2019 "Controllable Attention for Structured Layered Video Decomposition",
Alayrac, J-B. and Carreira, J. and Arandjelović, R. and Zisserman, A.
IEEE/CVF International Conference on Computer Vision

2019 "Scalable Verified Training for Provably Robust Image Classification",
Gowal, S. and Dvijotham, K. and Stanforth, R. and Bunel, R. and Qin, C. and Uesato, J. and Arandjelović, R. and Mann, T. and Kohli, P.
IEEE/CVF International Conference on Computer Vision

2019 "Object Discovery with a Copy-Pasting GAN",
Arandjelović, R. and Zisserman, A.
CoRR, abs/1905.11369

2018 "Neighbourhood Consensus Networks",
Rocco, I. and Cimpoi, M. and Arandjelović, R. and Torii, A. and Pajdla, T. and Sivic, J.
Neural Information Processing Systems
*** Spotlight presentation ***

2018 "Objects that Sound",
Arandjelović, R. and Zisserman, A.
European Conference on Computer Vision

2018 "Convolutional neural network architecture for geometric matching",
Rocco, I. and Arandjelović, R. and Sivic, J.
IEEE Transactions on Pattern Analysis and Machine Intelligence

2018 "On the effectiveness of interval bound propagation for training verifiably robust models",
Gowal, S. and Dvijotham, K. and Stanforth, R. and Bunel, R. and Qin, C. and Uesato, J. and Arandjelović, R. and Mann, T. and Kohli, P.
NeurIPS workshop on Security in Machine Learning
*** Best paper award, Oral presentation ***

2018 "Training verified learners with learned verifiers",
Dvijotham, K. and Gowal, S. and Stanforth, R. and Arandjelović, R. and O'Donoghue, B. and Uesato, J. and Kohli, P.
CoRR, abs/1805.10265

2018 "End-to-end weakly-supervised semantic alignment",
Rocco, I. and Arandjelović, R. and Sivic, J.
IEEE Conference on Computer Vision and Pattern Recognition

2018 "GhostVLAD for set-based face recognition",
Zhong, Y. and Arandjelović, R. and Zisserman, A.
Asian Conference on Computer Vision

2018 "Compact Deep Aggregation for Set Retrieval",
Zhong, Y. and Arandjelović, R. and Zisserman, A.
ECCV workshop on Compact and Efficient Feature Representation and Learning in Computer Vision
*** Best paper award, Oral presentation ***

2017 "Look, Listen and Learn",
Arandjelović, R. and Zisserman, A.
IEEE International Conference on Computer Vision

2017 "NetVLAD: CNN architecture for weakly supervised place recognition",
Arandjelović, R. and Gronat, P. and Torii, A. and Pajdla, T. and Sivic, J.
IEEE Transactions on Pattern Analysis and Machine Intelligence

2017 "Convolutional neural network architecture for geometric matching",
Rocco, I. and Arandjelović, R. and Sivic, J.
IEEE Conference on Computer Vision and Pattern Recognition
*** Spotlight presentation ***

2017 "24/7 place recognition by view synthesis",
Torii, A. and Arandjelović, R. and Sivic, J. and Okutomi, M. and Pajdla, P.
IEEE Transactions on Pattern Analysis and Machine Intelligence

2016 "NetVLAD: CNN architecture for weakly supervised place recognition",
Arandjelović, R. and Gronat, P. and Torii, A. and Pajdla, T. and Sivic, J.
IEEE Conference on Computer Vision and Pattern Recognition
*** Oral presentation ***

2016 "Pairwise Quantization",
Babenko, A. and Arandjelović, R. and Lempitsky, V.
CoRR, abs/1606.01550

2016 "Faces in Places: Compound query retrieval",
Zhong, Y. and Arandjelović, R. and Zisserman, A.
British Machine Vision Conference

2015 "24/7 place recognition by view synthesis",
Torii, A. and Arandjelović, R. and Sivic, J. and Okutomi, M. and Pajdla, P.
IEEE Conference on Computer Vision and Pattern Recognition

2015 "On-the-fly Learning for Visual Search of Large-scale Image and Video Datasets",
Chatfield, K. and Arandjelović, R. and Parkhi, O. and Zisserman, A.
International Journal of Multimedia Information Retrieval

2014 "Extremely low bit-rate nearest neighbor search using a Set Compression Tree",
Arandjelović, R. and Zisserman, A.
IEEE Transactions on Pattern Analysis and Machine Intelligence

2014 "Visual vocabulary with a semantic twist",
Arandjelović, R. and Zisserman, A.
Asian Conference on Computer Vision

2014 "DisLocation: Scalable descriptor distinctiveness for location recognition",
Arandjelović, R. and Zisserman, A.
Asian Conference on Computer Vision

2014 "Re-presentations of Art Collections",
Chung, J. S., Arandjelović, R., Bergel G., Franklin, A. and Zisserman, A.
ECCV workshop on Computer Vision for ART Analysis (VISART)

2013 "Advancing Large Scale Object Retrieval",
Arandjelović, R.
PhD thesis from University of Oxford

2013 "All about VLAD",
Arandjelović, R. and Zisserman, A.
IEEE Conference on Computer Vision and Pattern Recognition

2013 "Content-Based Image-Recognition on Printed Broadside Ballads: The Bodleian Libraries' ImageMatch Tool",
Bergel, G. and Franklin, A. and Heaney, M. and Arandjelović, R. and Zisserman, A. and Funke, D.
IFLA World Library and Information Congress

2012 "Three things everyone should know to improve object retrieval",
Arandjelović, R. and Zisserman, A.
IEEE Conference on Computer Vision and Pattern Recognition

2012 "Multiple queries for large scale specific object retrieval",
Arandjelović, R. and Zisserman, A.
British Machine Vision Conference

2012 "Name that Sculpture",
Arandjelović, R. and Zisserman, A.
ACM International Conference on Multimedia Retrieval
*** Best paper candidate, Oral presentation ***

2011 "Smooth Object Retrieval using a Bag of Boundaries",
Arandjelović, R. and Zisserman, A.
IEEE International Conference on Computer Vision
*** Most remembered poster, Spotlight presentation ***

2011 "Sketch recognition by fusion of temporal and image-based features",
Arandjelović, R. and Sezgin, T. M.
Pattern Recognition

2010 "Efficient Image Retrieval for 3D Structures",
Arandjelović, R. and Zisserman, A.
British Machine Vision Conference