Paul Hill

Machine Learning Professional

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Bristol, U.K.
csprh.github.io
+44 7774006400
Paul.Hill@bristol.ac.uk
linkedin.com/in/paul-hill-28a844148
github.com/csprh

Education and Qualifications

2002	**PhD**	University of Bristol: Electrical and Electronic Engineering
1997	**MSc (Dist)**	University of Bristol: Computer Science
1995	**BSc (1st)**	Open University: Computer Science
2006	**MA (Dist)**	Bath Spa University: Creative Music Technology

Positions held

2024–	**Senior AI Research Fellow**, Department of Electrical & Electronic Engineering, The University of Bristol.
2024	**Senior AI Research Engineer**, Samsung Research UK (SRUK)
2023	**Lead AI Research Engineer**, Enoda Ltd
2022–2023	**Machine Learning Lead (NLP)**, Cube Global Ltd
2021–2022	**Machine Learning Technical Lead (Vision Systems)**, SeeByte Ltd
2003–2021	**Senior Research Fellow, Research Assistant**, Department of Electrical & Electronic Engineering, The University of Bristol.
2008–2021	**Lecturer**, Department of Electrical & Electronic Engineering, The University of Bristol.
2002–2003	**Senior Engineer**, Provision Communications ltd., Bristol, U.K.
1998–2001	**Research Assistant**, University of Bristol: Department of Electrical and Electronic Engineering (Sponsored by Texas-Instruments).
1995–1998	**IT Support**, Sustrans, Bristol, U.K.

Industry

- Senior Research Engineer at Samsung Research UK (SRUK) optimising federated analytics.
- Lead Research Engineer at Enoda investigating power load modelling, federated learning for transformer based processing.
- Machine Learning Lead at financial regulation analysis company Cube Global.
- Machine Learning Technical Lead at undersea robotics company SeeByte.
- Within SeeByte: lead engineer developing classification (CNNs etc.), generation (GANs etc.) and control (Reinforcement Learning) technology for vision applications.
- Project and team management, software development, writing funding bids and client liaison.

Skills

- Project management, Line Management, Team Leading, Jira, Phabricator, Confluence.
- Cloud computing (GCP).
- Data science, statistical analysis, signal processing: Python, Matlab, C, C++, C#, JAVA, Javascript.
- Tensorflow, Pytorch, Caffe: Git, Phabricator, Docker, SVN.
- Technical writing: Microsoft Office, Latex.

Teaching

- Previously lecturer and unit organizer of MSc Speech and Audio Technology course for 13 years (average student review score of 4.4/5 over the last 5 years).
- Other Masters and Undergraduate level courses taught have included: Image and Video Coding, Communications lab, Optimal Signal Processing (I replaced Professor Alin Achim's teaching of this course for his year-long secondment last year).

- I have co-supervised six PhD students and supervised 45 Masters students and undergraduate students. Conducted internal and external vivas (PhD, MSc).
- Published the book "Audio and Speech Processing using MATLAB", Taylor and Francis, January 2019

Research

- Since 2001 I have authored 55 journal papers, conference papers, chapters and a book. A list of selected publications appears below. I have an h-index of 19 with over 1600 citations (Google Scholar).
- My most recent research involves the analysis and evaluation of audience immersion within theatre and online environments (funded by the ISCF Bristol & Bath Creative Industry Cluster). This is achieved using computer vision and machine learning techniques together with specifically designed psychological experiments.
- I have also engaged in research into the next generation of visual codecs; specifically the development of novel neural network architectures for combined classification and compression (DASA: funded by DSTL, collaborating with Thales).

Research Projects

2023–2024	**Turbulence Mitigation**: DSTL project (DASA). Video based atmospheric turbulence reduction combined with object detection.
2016–2019	**Harmful Algal Bloom Detector**: Collaborating with MASDAR, UAE, this British Council funded project generated a state-of-the-art early detector of Harmful Algal Blooms using combined machine learning and remote sensing techniques together with distributed learning techniques (Slurm/PyTorch)
2014–2016	**Visual Signal Analysis and Processing (VSAP)**: Collaborating with KUSTAR, UAE (project funding body), perceptual image processing techniques were defined and implemented resulting in new wavelet-based Contrast Sensitivity Functions (CSFs) and a newly defined method of perceptual image fusion.
2011–2014	**Undersea Mine Detection**: Projects funded by DSTL, ATLAS and Seebyte generated and refined an Automatic Target Recognition (ATR) system for detecting seabed mines from side-scan sonar and SAS imagery. The project developed novel feature extraction methods combined with machine learning methods such as optimised SVMs and Adaptive Boosting.
2010–2011	**Scalable Image Fusion**: Funded by DSTL, this project defined and implemented a novel 3D wavelet video codec with integrated scalable video fusion.
2009-2010	**UAV Optimised Compression**: Available bandwidth is severely restricted in military air-ground video transmission applications. I created and implemented a telemetry logger for a UAV and developed a novel system for using telemetry within the video coding process (H.264), optimising rate-distortion performance.
2007–2009	**VISUALISE**: The VISUALISE project produced rate-quality optimised video codecs using sprite coding within an H.264 structure. Furthermore, 3D texture synthesis methods were developed to replace temporally predictable 2D+t regions within video sequences. For the same perceptual quality, significant bitrate reductions were achieved.
2006–2008	**Provision Communications**: H.264 optimisation coding for a DSP platform was implemented together with an H.264 rate-control algorithm.
2004–2007	**ROAM4G**: ROAM4G generated optimised video codecs for wireless transmission. An interpolation free subpixel motion estimation system for H.264 using kernel methods based within the Hough transform domain was created to give optimised coding performance and complexity reduction.
2009–2010	**Low Light Image Enhancement and Artificial Colourisation**: Funded by General Dynamics this project utilised previously developed denoising methods within the complex wavelet domain to enhance low light imagery. A project extension used image segmentation and regional correlations to generate coloured imagery from monochrome inputs
2001–2002	**Content Based Retrieval System**: Funded by Texas Instruments, this project used JPEG2000 transform coefficients to generate features within a novel content-based image retrieval system.

1998–2001 **Digital Virtual Centre of Excellence (DVCE)**: Development of texture characterisation and segmentation techniques. The segmentation methods were based on a completely new paradigm of texture gradient analysis using complex wavelets.

Research income: Total: £1.01M. PI: £388,906, CoI: £622,340

2016–2019	**PI:** Detection, Prediction and Prevention of Harmful Algal Bloom Events Collaborators: MASDAR, UAE. Funder: British Council	£300,063
2016	**PI:** Context Adaptive ATR. Collaborators: DSTL. Funder: Seebyte	£26,978
2012	**PI:** Scalable Fusion Architectures. Funder: DSTL	£61,865
2020	**Co-I:** Live Music-Making in the No-Fly, No-Contact World Collaborators: Department of Music, UoB. Funder: The Cabot Institute	£13,572
2016–2019	**Co-I:** Perceptual Denoising I & II Collaborators: Department of Psychology. UoB, Funder: EPSRC Platform Grant	£198,592
2017–2018	**Co-I:** Automated Alert System for Volcanic Unrest in Developing Countries. Collaborators: Department of Earth Sciences, UoB. Funder: NERC	£63,127
2016	**Co-I:** Underwater Assured Detection and Classification Collaborators: DSTL. Funder: Atlas Elektronik	£29,302
2013–2015	**Co-I:** ITP Domain Optimised Compression Phase. Funder: DSTL	£192,210
2013–2014	**Co-I:** A Unified Framework for Scalable Video Super-Resolution and Fusion Funder: DSTL	£91,355
2012	**Co-I:** RFEL Image Fusion Study. Funder: DSTL	£22,342
2010–2011	**Co-I:** MBDA-Image Compression using JPEG2000. Funder: MBDA	£11,840

Awards

- NVIDIA GPU Grant 2018: Award of NVIDIA Titan Xp card for use in remote sensing projects
- Huawei Denoising AI Competition UK 2018 - Top 5 prize

Patent Application

- GB 050035.5: Interpolation Free Sub-Pixel Accuracy Motion Compensation

Volunteering in Research Community

- Organising committee member of the Grand Challenge “Encoding in the Dark” in IEEE International Conference on Multimedia and Expo (ICME 2020), London, U.K.
- Organising committee member (local organisation) of the Picture Coding Symposium (PCS 2021), Bristol, U.K.
- Reviewer for Journals and Conference including: IEEE Transactions on Image Processing, IEEE Signal Processing Letters, IEEE Transactions on Multimedia, ICIP, ICASSP, PCS, BMVC etc.

Supervision / Departmental Activities

- PhD co-supervisor (6 students), Masters and Undergraduate supervisor (45 students), internal PhD viva assessor (6 students). Masters tutor (6 students per year).
- Member of internal and external exam boards
- Organising committee member (local organisation) of the Picture Coding Symposium 2021, Bristol, UK.
- Member of the Department of Electrical and Electronic Engineering’s plagiarism Committee,

Outreach

2019	Presentation and organisation of the School’s **Headstart Summer School** (sponsored by UKESF): Talk for A-level students on the Topic: “Mathematics of Music”.
2011–	Volunteer at the Department’s open day.
2007–2008	Demonstrator at the **Science Alive** project within the University’s outreach programme (Broadmead shopping centre, Bristol).

Recent Invited Presentations and Talks

11/09/2019	**ACRC Symposium**	Talk on the use of Bristol's HPC facilities: Machine learning for the detection of Harmful Algal Blooms
31/01/2018	**NERC: Volcano Symposium**	Machine Learning, Image Processing and their Potential Application to Volcano Applications
10/05/2018	**Changing Ice, Cabot Institute workshop on Climate Change**	Machine Learning and Remote Sensing
31/01/2018	**Workshop on Image Processing and Machine Learning in Volcano Remote Sensing**	Image Processing and Machine Learning
23/02/2017	**BVI Presentation**	Perceptually Based Image Fusion
31/01/2017	**FRED Talk (EEng Dept Bristol)**	The Well Tempered Integral: The Maths of Music
01/06/2016	**Workshop for Sony R&D**	Image Segmentation and Fusion
09/11/2015	**VSAP Workshop: KUSTAR, Abu Dhabi**	Image and Video Fusion
01/09/2014	**BVI Presentation**	Wavelets and Complex Wavelets for Image Processing

Consultancy

2018 Volunteer consultancy: Denoising on Blue Planet II, The BBC. I provided advice and research for denoising an underwater sequence for the BBC in Bristol.

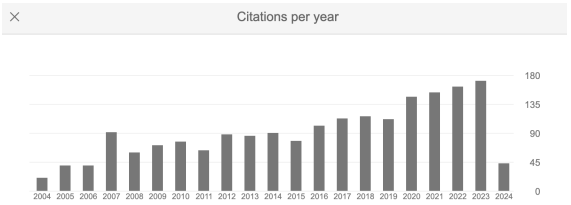
2008 Consultant in patent infringement case for lawyers Wragge and Co: MPEG-2 Technology - Patent Review.

2002 Car video tracking: British American Racing (BAR). I provided tracking methods for on car video from the BAR Formula 1 car.

2001 Audio monitoring of NTL (Virgin Media) video distribution centre. I developed the BRAHMS audio monitoring system that simultaneously monitored over 100 channels for the Virgin Media video distribution centre.

Publications

I have authored 55 papers in total. I have an h-Index of 19 and over 1950 citations. Please see my Google Scholar page: scholar.google.com/citations?user=luxEujEAAAAJ



Journal Papers / Book Chapters

1. **Hill, P.**, Biggs, J., Lopez, V. P., Bull, D., (2021). Time-series Prediction Approaches to Forecasting Deformation in Sentinel-1 Insar Data, (Accepted). *Journal of Geophysical Research: Solid Earth*.
2. **Hill, P. R.**, Kumar, A., Temimi, M., Bull, D. R., (2020). HABNet: Machine Learning, Remote Sensing-Based Detection of Harmful Algal Blooms. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* **13**, 3229–3239.
3. Anantrasirichai, N., Biggs, J., Albino, F., **Hill, P.**, Bull, D., (2018). Application of machine learning to classification of volcanic deformation in routinely generated InSAR data. *Journal of Geophysical Research: Solid Earth* **123**(8), 6592–6606.
4. Kim, J., Mamou, J., **Hill, P. R.**, Canagarajah, N., Kouamé, D., Basarab, A., Achim, A., (2017). Approximate message passing reconstruction of quantitative acoustic microscopy images. *IEEE transactions on ultrasonics, ferroelectrics, and frequency control* **65**(3), 327–338.
5. **Hill, P.**, Achim, A., Al-Mualla, M. E., Bull, D., (2016). Contrast sensitivity of the wavelet, dual tree complex wavelet, curvelet, and steerable pyramid transforms. *IEEE Transactions on Image Processing* **25**(6), 2739–2751.
6. **Hill, P.**, Al-Mualla, M. E., Bull, D., (2016). Perceptual image fusion using wavelets. *IEEE transactions on image processing* **26**(3), 1076–1088.
7. **Hill, P. R.**, Anantrasirichai, N., Achim, A., Al-Mualla, M. E., Bull, D. R., (2015). Undecimated dual-tree complex wavelet transforms. *Signal Processing: Image Communication* **35**, 61–70.

8. **Hill, P. R.**, Achim, A., Bull, D. R., Al-Mualla, M. E., (2014). Dual-tree complex wavelet coefficient magnitude modelling using the bivariate Cauchy–Rayleigh distribution for image denoising. *Signal Processing* **105**, 464–472.
9. Łoza, A., Bull, D. R., **Hill, P. R.**, Achim, A. M., (2013). Automatic contrast enhancement of low-light images based on local statistics of wavelet coefficients. *Digital Signal Processing* **23**(6), 1856–1866.
10. **Hill, P. R.**, Bull, D. R., (2010). Sub-pixel motion estimation using kernel methods. *Signal Processing: Image Communication* **25**(4), 268–275.
11. **Hill, P. R.**, Canagarajah, C. N., Bull, D. R., (2003). Image segmentation using a texture gradient based watershed transform. *IEEE Transactions on Image Processing* **12**(12), 1618–1633.
12. Nikolov, S., **Hill, P.**, Bull, D., Canagarajah, N., (2001). "Wavelets for image fusion". In: *Wavelets in signal and image analysis*. Springer, Dordrecht, pp.213–241.

Selected Conference Papers

1. Levordashka, A., Stanton Fraser, D., Gilchrist, I., Chadwick, E., **Hill, P.,** (2021). Sensing the Audience in digital streaming: Lessons from a global pandemic. *CHI Conference on Human Factors in Computing Systems: (Submitted)*.
2. Gillan, A., **Hill, P.,** (2019). Harmonic-band Complex Wavelet Transform Audio Analysis and Synthesis. In: *ICASSP 2019-2019 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*. IEEE, pp.850–854.
3. **Hill, P.**, Bull, D., (2018). Image Fusion Using Belief Propagation. In: *2018 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*. IEEE, pp.1817–1821.
4. **Hill, P. R.**, Bhaskar, H., Al-Mualla, M. E., Bull, D. R., (2016). Improved illumination invariant homomorphic filtering using the dual tree complex wavelet transform. In: *2016 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*. IEEE, pp.1214–1218.
5. **Hill, P. R.**, Kim, J.-H., Basarab, A., Kouamé, D., Bull, D. R., Achim, A., (2016). Compressive imaging using approximate message passing and a Cauchy prior in the wavelet domain. In: *2016 IEEE International Conference on Image Processing (ICIP)*. IEEE, pp.2514–2518.
6. **Hill, P. R.**, Achim, A., Bull, D. R., (2013). Scalable video fusion. In: *2013 IEEE International Conference on Image Processing*. IEEE, pp.1277–1281.
7. **Hill, P. R.**, Achim, A., Bull, D. R., Al-Mualla, M. E., (2013). Image denoising using dual tree statistical models for complex wavelet transform coefficient magnitudes. In: *2013 IEEE International Conference on Image Processing*. IEEE, pp.88–92.
8. **Hill, P.**, Achim, A., Bull, D., (2012). The undecimated dual tree complex wavelet transform and its application to bivariate image denoising using a cauchy model. In: *2012 19th IEEE International Conference on Image Processing*. IEEE, pp.1205–1208.
9. **Hill, P. R.**, Bull, D. R., (2009). Kernel based sub-pixel motion estimation. In: *2009 16th IEEE International Conference on Image Processing (ICIP)*. IEEE, pp.1557–1560.
10. **Hill, P. R.**, Canagarajah, C. N., Bull, D. R., (2002). Image Fusion Using Complex Wavelets. In: *BMVC*, pp.1–10.

Books

1. **Hill, P.** (2019). *Audio and Speech Processing with MATLAB*, *Taylor and Francis*.

References

David Bull (dave.bull@bristol.ac.uk) Professor, Post-doc Supervisor, *Department of Electrical & Electronic Engineering*, University of Bristol, Bristol, UK.

Alin Achim (alin.achim@bristol.ac.uk) Professor, Research Collaborator, *Department of Electrical & Electronic Engineering*, University of Bristol, Bristol, UK.