

CURRICULUM VITAE

Iain E Richardson

Internationally known expert on video compression standards including MPEG-2, H.264 and HEVC. Author of four widely cited books on video and image coding, experienced expert witness in US and international patent litigation cases.

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Personal Profile

An international expert on compression coding, I am the author of four books and over 70 journal and conference papers on video compression, including two widely cited books on the H.264 / MPEG-4 standards. I regularly advise companies on video compression and streaming technology, video coding patents and technology acquisitions. I have acted as an expert witness in multiple US and EU patent litigation cases. I have given expert testimony in San Diego, New York, Washington DC and The Hague and regularly give invited lectures on video compression coding, most recently at the Smithsonian Institution and the US Patent and Trademark Office.

I have made an internationally significant contribution to research in the field of image and video compression. This is the essential technology for applications such as digital television, internet video streaming and video on mobile phones. My research has addressed the growing challenge faced by industry, namely how to support sophisticated video compression on an increasing range of devices and platforms. I am a member of British Standards Institute expert group IST/37, the committee which represents the UK in ISO/IEC MPEG standardisation.

I invented and commercialised Beamshare, a novel technology for rapid and secure sharing and streaming of video and other media. Beamshare is now in use in industries such as Search and Rescue and broadcast video production.

I am based in the UK and travel several times a year to the US.

Qualifications

M.Eng. (1990), Heriot-Watt University, Edinburgh, UK
Ph.D. (1999), Robert Gordon University, Aberdeen, UK

Employment experience

2006 - present	Managing Director, Vcodex Ltd, Aberdeen, UK
2009 – 2015	Managing Director, Onecodec Ltd, Aberdeen, UK
1993 - 2010	Full Professor, School of Engineering, The Robert Gordon University

1995 - 2000
1990 - 1993

Director, 4i2i Communications Ltd
Digital Signal Processor Designer, GEC Ltd, Edinburgh

Expert witness and intellectual property experience

An experienced expert witness in patent litigation cases, I have testified at deposition and trial in:

1. United States District Court (Southern District of California) Case No. 05cv1958 B(BLM), San Diego, USA, 2006-2007 (Video compression, H.264)
2. United States International Trade Commission Investigation 337-TA-724, Washington DC, 2011 (Graphics compression)
3. United States District Court (Southern District of California) Case No. 3:10-cv-02618, San Diego, USA, 2012 (Video compression, MPEG-2 and H.264)
4. United States International Trade Commission Investigation 337-TA-837, Washington DC, 2013 (Data / video compression, H.264)

I have testified at deposition in:

5. United States International Trade Commission Investigation 337-885, New York City, 2013 (Video compression)
6. Patent Trial and Appeal Board, Inter Partes Review IPR2015-00302, Washington DC, 2015 (Data and video compression)
7. Patent Trial and Appeal Board, Inter Partes Review IPR2015-01089, Washington DC, 2016 (Data and video compression)

I have been engaged by a number of US and EU law firms to provide patent portfolio analysis and expert witness services, including:

- Finnegan, Henderson, Farabow, Garrett & Dunner, LLP
- Cooley LLP
- Young Basile Hanlon & MacFarlane P.C.
- Quinn Emanuel Urquhart & Sullivan, LLP
- Kilpatrick Townsend & Stockton LLP
- Novak Druce Connolly Bove + Quigg LLP
- Polsinelli P.C.

Publications

Books/Chapters/Theses

1. Iain Richardson, *H.264 Advanced Video Compression*, John Wiley and Sons, May 2010.
2. Iain Richardson, *H.264 and MPEG-4 Video Compression*, John Wiley and Sons, 2003.
3. Iain Richardson, *Video Codec Design*, John Wiley & Sons, 2002.
4. Iain Richardson, "Coefficient Modelling in a Block-Based Video CODEC", in *IMAGE PROCESSING III: Mathematical Methods, Algorithms and Applications*, Horwood Publishing, ISBN 1-898563-72-1, 2001.
5. Iain Richardson, "Video Coding for Reliable Communications", PhD Thesis, The Robert Gordon University, October 1999.
6. Mohammed Ghanbari and Iain Richardson (editors), *Proceedings of International Workshop on Audio-Visual Services over Packet Networks*, 1997.

7. M J Riley and Iain Richardson, *Digital Video Communications*, Artech House, 1997.

Standards contributions

1. Y. Zhao, M. Bystrom, C.S. Kannangara, I. Richardson and J. Philp, "A Random Access Protocol for Configurable Video Coding", Document M16927, ISO/IEC JTC1/SC29/WG11 (MPEG), China, October 2009.
2. I.E. Richardson, C.S. Kannangara, M. Bystrom, J. Philp and Y. Zhao, "Fully Configurable Video Coding, Part 2 - A Proposed Platform for Reconfigurable Video Coding", Document M16752, ISO/IEC JTC1/SC29/WG11 (MPEG), London, July 2009.
3. I.E. Richardson, C.S. Kannangara, M. Bystrom, J. Philp and Y. Zhao, "Fully Configurable Video Coding, Part 1 - Overview", Document M16751, ISO/IEC JTC1/SC29/WG11 (MPEG), London, July 2009.

Journal papers

1. A. Bhat, C. S. Kannangara, Y. Zhao and I. Richardson, "A Full Reference Quality Metric for Compressed Video Based on Mean Squared Error and Video Content", *IEEE Trans. Circuits and Systems for Video Technology*, Vol 22:2, February 2012.
2. A. Bhat, I. Richardson and C. S. Kannangara, "A new perceptual quality metric for compressed video based on mean squared error", *Signal Processing: Image Communication*, Vol 25, 2010, pp. 588 - 596
3. M Bystrom, I Richardson, S Kannangara and M de Frutos-Lopez, "Dynamic Replacement of Video Coding Elements", *Signal Processing:Image Communication*, Vol 25:4, April 2010.
4. C S Kannangara, I E Richardson , M Bystrom & Y Zhao, "Complexity Control of H.264/AVC based on Mode-conditional Cost Probability Distributions", *IEEE Trans. Multimedia*, April 2009.
5. C S Kannangara, I E Richardson & A J Miller, "Computational Complexity Management of a Real-Time H.264/AVC Encoder", *IEEE Trans. Circuits and Systems for Video Technology*, September 2008.
6. M. Bystrom, I. Richardson and Y. Zhao, "Efficient Mode Selection for H.264 Complexity Reduction in a Bayesian Framework," *Signal Processing: Image Communication*, vil. 23, iss. 2, pp. 71-86, February 2008.
7. C S Kannangara, I E G Richardson, M Bystrom, J Solera, Y Zhao, A MacLennan & R Cooney, "Low Complexity Skip Prediction for H.264 through Lagrangian Cost Estimation", *IEEE Transactions on Circuits and Systems for Video Technology*, February 2006.
8. L Muir and I E G Richardson, "Perception of Sign Language and its Application to Visual Communications for Deaf People", *Journal of Deaf Studies and Deaf Education*, September 2005.
9. I E G Richardson and S Kannangara, "Fast subjective video quality measurement with user feedback", *Electronics Letters* Vol. 40, Number 13, June 2004 pp. 799-800.
10. Y Zhao and I E G Richardson, "Macroblock Classification for Complexity Management of Video Encoders", *Signal Processing: Image Communication*, Vol. 18, Issue 9, Oct. 2003 pp. 801-811.

11. I E G Richardson and Y Zhao, "Adaptive Management of Video Encoder Complexity", *Journal of Real-Time Imaging*, Vol. 8, No. 4, Aug 2002, pp. 291-301.
12. I E G Richardson, M J Riley, W Haston and I Armstrong, "Telemedicine and teleconferencing: the SAVIOUR project", *IEE Computing and Control journal*, January 1996.
13. I E G Richardson and M J Riley, "Improving the error tolerance of MPEG video by varying slice size", *Signal Processing journal*, Vol. 46, No. 3, October 1995.

Papers in refereed conference proceedings

1. A. Bhat, I. E. Richardson & C. S. Kannangara, "A Novel Perceptual Quality Metric for Video Compression", Proc. International Picture Coding Symposium 2009, Chicago, May 2009.
2. I. Richardson, C. S. Kannangara, M. Bystrom, J. Philp and M. De. Frutos-Lopez, "A Framework for Fully Configurable Video Coding," Proc. International Picture Coding Symposium 2009, Chicago, May 2009.
3. A. Bhat, I. Richardson and S. Kannangara, "A New Perceptual Quality Metric for Compressed Video", Proc. ICASSP 2009, Taipei, Taiwan, April 2009.
4. C. S. Kannangara, I. Richardson, M. Bystrom, M. de-Frutos-Lopez, "Fast, Dynamic Configuration of Transforms for Video Coding", Proc. ICIP 2008, San Diego, California, October 2008.
5. I E Richardson, "Dynamic Configuration: Beyond Video Coding Standards", Invited Plenary Presentation, *IEEE System on Chip Conference (SOCC08)*, Newport Beach, CA, September 2008.
6. I. Richardson, M. Bystrom, M. de-Frutos-Lopez, C. S. Kannangara, "Dynamic Transform Replacement in an H.264 Codec", Proc. ICIP 2008, San Diego, California, October 2008.
7. Chaminda Kannangara, Yafan Zhao, Iain Richardson and Maja Bystrom, "Complexity Control of H.264 Based on a Bayesian Framework", Proc. PCS 2007, Portugal, November 2007.
8. Y Zhao, M Bystrom and I E Richardson, " A MAP Framework for Efficient SKIP/CODE Mode Decision in H.264", Proceedings of International Conference on Image Processing, Atlanta, USA, 8-11 October 2006.
9. C S Kannangara, I E Richardson and A Miller, "Computational Management of an H.264 Encoder," Proceedings of International Picture Coding Symposium, Beijing, China, 24~26 April 2006.
10. I E Richardson, M Bystrom and Y Zhao, "Fast H.264 Skip Mode Selection Using an Estimation Framework", Proceedings of International Picture Coding Symposium, Beijing, China, 24-26 April, 2006.
11. C. S. Kannangara and I. E. Richardson, "Computational Control of an H.264 Encoder Through Lagrangian Cost Function Estimation", International Workshop on Very Low Bitrate Video, Sardinia, Italy, 15-16 September 2005.
12. L J Muir, I E G Richardson and K Hamilton, "Visual perception of Content-Prioritised Sign Language Video Quality". Proceedings IEE Visual Information Engineering, Glasgow. 4 ~ 6 April 2005.
13. Y Zhong, I Richardson, A Miller and Y Zhao, " Perceptual Quality Of H.264/AVC Deblocking Filter", Proceedings IEE Visual Information Engineering, Glasgow, 4~6 April, 2005.
14. C S Kannangara, I E G Richardson, M Bystrom, J Solera, Y Zhao, A MacLennan & R Cooney, "Complexity Reduction of H.264 using Lagrange Optimization

- Methods," Proceedings IEE Visual Information Engineering, Glasgow, 4~6 April, 2005.
15. I E G Richardson and Y Zhao, "Video Encoder Complexity Reduction by Estimation Skip Mode Distortion", Proc. ICIP 2004, Singapore, Oct. 2004.
 16. Y Zhong, I Richardson, A Sahraie and P McGeorge, "Influence of Task and Scene Content on Subjective Video Quality", Lecture Notes in Computer Science, Volume 3211 / 2004, pp. 295.
 17. W W Lee, I E G Richardson and R Staff, "Volumetric Analysis of Brain MRI scans Using Geometric Deformable models. ", ESMRMB 2004, September 2004, Copenhagen.
 18. C S Kannangara, I E G Richardson and Y Zhao, "H.264 Complexity Management using Macroblock Skip-Mode Prediction", PGNet, Liverpool, June 2004.
 19. Y Zhong, I Richardson, A Sahraie and P McGeorge, "Qualitative and quantitative assessment in video compression", 12th European Conference on Eye Movements, 20-24 August 2003, Dundee, Scotland.
 20. Yafan Zhao and Iain Richardson, "Macroblock skip-mode prediction for Complexity control of Video Encoders", IEEE Visual Information Engineering, Surrey, July 2003.
 21. Laura Muir, Iain Richardson, Steven Leaper, "Gaze tracking and its application to video coding for sign language", International Picture Coding Symposium 2003, Saint Malo - France, 23~25, April 2003 .
 22. Yafan Zhao, Iain Richardson, "Macroblock classification for video encoder complexity management", International Picture Coding Symposium 2003, Saint Malo - France, 23~25, April 2003.
 23. Y Zhao and I E G Richardson, "Complexity Management for Video Encoders", Doctoral Symposium, ACM Multimedia Conference, Juan Les Pins, France, 1-6 December 2002.
 24. L Muir and I E G Richardson, "Video Telephony for the Deaf: Analysis and Development of an Optimised Video Compression Product", Doctoral Symposium, ACM Multimedia Conference, Juan Les Pins, France, 1-6 December 2002.
 25. Y Zhao, L Muir and I E G Richardson, "Implementing MPEG-4 Visual in software", IEE Seminar on Visual Media Standards, 25 April 2002
 26. Y Zhao and I E G Richardson, "Computational Complexity Management of Motion Estimation in Video Encoders", IEEE Data Compression Conference (DCC02), Snowbird, Utah, April 2002.
 27. I E G Richardson and Y Zhao, "Adaptive Algorithms for Variable Complexity Video Coding", Proc. International Conference on Image Processing (ICIP01), Thessaloniki, Greece, October 2001.
 28. I E G Richardson and Y Zhao, "Video CODEC Complexity Management", Proc. International Picture Coding Symposium (PCS01), Seoul, Korea, April 2001 .
 29. I E G Richardson, K Kipperman et al, "Video Coding using Digital Signal Processors", DSP World Fall Design Conference, Orlando, USA, November 1999 (invited workshop).
 30. M J Riley, I E G Richardson, K Kipperman, L Muir and G Smith, "High speed bit accurate communication system modelling in C", Proc. DSP World Spring Design Conference, Santa Clara, USA, April 1999.
 31. I E G Richardson, A J Turnbull and M J Riley, "Temporal Filtering of Coded Video", Proc. SPIE Int. Conf. on Digital Compression Technologies and Systems for Video Communications, Berlin, October 1996.

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