AWARD TITLE: IEEE SPS 2012 Society Award

NOMINEE: Professor Alan C Bovik

SUGGESTED CITATION: *For Seminal Contributions to Perception-based Image and Video Processing*.

NOMINATING TECHNICAL COMMITTEE: IVMDSP

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PLEASE ATTACH A SUCCINCT STATEMENT SUPPORTING THE NOMINATION:

Al Bovik
IEEE Signal Processing Society (SPS) <u>Society Award</u> Nomination
Citation: *For Seminal Contributions to Perception-based Image and Video Processing*

We enthusiastically nominate **Professor Al Bovik** for the IEEE SPS **Society Award.** Al is an ideal choice for this signal honor owing to his remarkable record of technical innovation and high-impact leadership for 32 years. Al has substantially shaped the direction and advancement of the field of Digital Image and Video Processing through his many seminal contributions in more than 600 publications and books and his groundbreaking educational work and professional service. Al is unusual in that his contributions are both broad and deep, making for an overall extraordinary impact on the field. We select his influential work in *Perception-based Image and Video Processing* as the technical basis for this Society Award nomination. However, it also recognizes his many other significant contributions to the field.

Outstanding Technical Contributions: Al's work in *Perception-based Image and Video Processing* has been extensive and seminal over the past 25 years. In the mid 1980's he published a seminal series of papers on perceptually-motivated multiscale image analysis, introducing *Gabor Filter Bank Models* of visual processing in primary cortex to our community. He demonstrated them to possess optimal properties for detecting, segmenting, and analyzing patterned natural images. This work predated wavelet theory, then merged seamlessly with it in important papers he published in several Special journal issues devoted to Wavelets. This work continues to deeply influence image analysis theory and practice. As part of this work Al also introduced the *Image Modulation Model* in the 1990's, describing image patterns using simple deterministic, non-parametric, non-stationary AM-FM functions. This model is extensively used for image analysis and has deeply impacted speech analysis. Al's work on Gabor/Modulation models has been cited >2,000 times.

In the 1990's Al wrote a definitive series of papers on models of *Foveated Sensing* by human retina. When fixations are predicted or tracked, great gains in compression and processing efficiency can be gained. Al formalized methods for foveated image/video compression and visual saliency, including the well-known *EFIC* algorithm. Al's foveation work has been cited almost 500 times; in the future, as display sizes (and bandwidths) increase and saliency methods improve, Al's work may form the basis for handling compressed video streams in foveated display and cinematic video systems.

Over the past decade, Al examined the old, difficult problem of automatic Image/Video Quality Assessment (QA), greatly advancing the field with the invention of the *Structural Similarity* (SSIM) *index* which achieved unusually high correlations with human judgments of visual quality. SSIM is now part of the H.264 video compression standard reference software and is used in commercial products. Al continued to push this frontier; producing ground-breaking natural scene statistics models for image QA including the top-performing *Visual Information Fidelity* (VIF) *index* and the standout *MOVIE index* for video QA. The image and video quality databases (including the results of large-scale human studies) published by Al's lab are *de facto* standard global resources downloaded 1,000's of times. Al's work in this area has been cited more than 10,000 times in the last few years. Recently Al has been developing *blind* (no reference), distortion-agnostic video QA models with human predictive performance comparable to SSIM. Such first-of-a-kind models will revolutionize video transport systems, as they can be embedded in network relays, wireless access points, smartphones, set-top boxes, etc.

Al has made vital contributions in many other realms, including vision science, where his contributions include proof that color is used in human stereoperception; the first measurements and statistical models of image statistics at visual fixations; the first models of bivariate 2D and 3D natural scene statistics; the first demonstration that human fixations in 3D avoid depth discontinuities, and so on; Also in nonlinear filter design, including the invention of order statistics filters; Also in digital microscopy, where he pioneered image analysis methods for confocal microscopy, optical sectioning microscopy, MFISH, Raman microscopy, stereo microscopy, and scanning electro-chemical microscopy.

Outstanding Technical Leadership: Al Bovik's publication record is voluminous and important (>20,000 cites and a current H-index of 57) including several books, dozens of book chapters, more than 200 archival journal papers and more than 350 conference papers. Al is widely honored for his technical work including the IEEE SPS Best Paper Award (2009) and Technical Achievement Award (2005), the 2011 IS&T/SPIE "Scientist of the Year Award," and Fellow status in IEEE, SPIE, OSA, and AIMBE. He is widely noted for his educational work and books, including the widely used and cited *Handbook of Image and Video Processing* and his groundbreaking online didactic educational tools culminating in the *SIVA* image/video processing online "liveware," use by >800 institutions world-wide and honored by the 2008 IEEE SPS Education Award. Al is noted for his many popular Plenary and Keynote speeches, including ICIP 2008 and IS&T/SPIE 2011 – more than a dozen in the past 5 years. Amongst his numerous professional service activities, Al is, of course, widely noted for creating image processing's main conference, the *IEEE International Conference on Image Processing* (ICIP) and co-creating image processing's main journal, the *IEEE Transactions on Image Processing,* of which Al was the longest-tenured Editor-in-Chief (1996-2002).

Because of his seminal, transformative technical contributions and his creative and generous and expansive leadership, we believe that Al Bovik richly deserves the IEEE Signal Processing *Society Award.*