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What Is Signal Processing?

I am returning to this perennial question that, in some sense, I already touched on in my March 2008 column. I am sure we are all often confronted with explaining signal processing to others, including nonexperts or the public in general. We may choose to explain it by what we and our colleagues do, as exemplified by the diversity and richness of the work of the IEEE Signal Processing Society's (SPS) technical committees and the topical coverage of our numerous solely sponsored or cosponsored conferences, workshops, and publications. Alternatively, we might turn to the cyber age oracle (Wikipedia) for an intuitive description (I suggest you read it).

I challenged two former SPS presidents, two future presidents, and our executive director to discuss the topic. More concretely, we considered how we could update the Society's field of interest statement to reflect the breadth and scope of signal processing as represented by the members of our Society. (The Society's field of interest can be found on our Web page. It was last revised in 1994 so it needs some updating.) If our discussions are successful, and we manage to get the words right, then a new field of interest will emerge for Board of Governors approval, and eventual approval by the IEEE Technical Activities Board (this approval occurs only after consideration, some negotiation, recalibration, and with luck, eventual support, by the other IEEE societies). I am writing this in August, with you reading it in November; thus, I cannot predict whether or not all interested parties will converge.

Now, back to the challenge. The current state of our discussions (I want to acknowledge my five comrades in "crime": Leah Jamieson, Rich Cox, Mos Kaveh, Ray Liu, and Mercy Kowalczyk, with the proviso that any error or mistake is my sole responsibility) are centered on two obvious questions, "What do we mean by *signal*?" and "How do we define *processing*?" Ages ago, *signal* referred to some physical manifestation of information that changed with time and/or space. By signal we may still be referring to a physical manifestation but we might also be dealing with other symbolic or abstract information formats like a sequence of millions of the four symbols of the genetic code (the DNA bases A, C, G, T) arranged into genes and noncoding sections. Or, we may be referring to some other abstract attributes of sequenced information: cold, hot, high, low. Examples of signals include audio, video, speech, language, image, multimedia, sensor, communication, geophysical, sonar, radar, biological, chemical, molecular, genomic, medical, musical, data, or sequences of attributes, or numerical quantities; the list goes on.

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As for *processing*, it comprises operations of representing, filtering, coding, transmitting, estimating, detecting, inferring, discovering, recognizing, synthesizing, recording, or reproducing signals by digital or analog devices, techniques, or algorithms, in the form of software, hardware, or firmware (Did we leave out other important techniques?).

So, putting it together, can we say that *signal processing* is an enabling technology that encompasses the fundamental theory, applications, algorithms, and implementations of processing or transferring information contained in many different physical, symbolic, or abstract formats broadly designated as signals and uses mathematical, statistical, computational, heuristic, and/or linguistic representations, formalisms, and techniques for representation, modeling, analysis, synthesis, discovery, recovery, sensing, acquisition, extraction, learning, security, or forensics?

Obviously, this definition is not for the kindergarten crowd. It's definitely been a challenge to get this far! I hope you will provide feedback and suggestions on how we can best describe *signal processing*. Our success will be evident when the term signal processing is understood at all levels.

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