ECE667 Technical Communication – Spring 2008

Homework 2

Due Sunday Feb 17, 2008

1. For each of the following items, write one few sentences identifying the logical flaw:

    a. The election couldn't have been fair – I don't know anyone who voted for the winner.
    b. It would be wrong to prosecute Zam-Zam Cola Company for ethnic discrimination; Zam-Zam has always been a great company.
    c. Increased restrictions on smoking in public are responsible for the decrease in smoking.
    d. Bill Jensen's proposal to create an on-site day-care center is just the latest of his ridiculous ideas.
    e. Since the introduction of cola drinks at the start of this century, cancer has become the second greatest killer in the country. Cola drinks should be outlawed.
    f. If mutual-fund guru Peter Lynch recommends this investment, I think we ought to buy it.
    g. We should not go into the DRAM market; we have always been a leading manufacturer of integrated processors.
    h. The other two hospitals in the city have implemented computerized patient recordkeeping; I think we need to do so, too.
    i. Our Model X500 didn't succeed in the market because we failed to sell a sufficient number of units.
    j. No researcher has ever established the Internet businesses can earn money; they will never succeed.

2. For each logical flaw type described in your class notes, create two statements of your own which have that flaw. For each statement that you create, explain why it is flawed.

3. Analyze the attached book review. Write a one page statement deconstructing the arguments in the paper. Be sure to include in your discussion the following

    a. Which arguments are strong and why?
    b. Which arguments are weak and why?
    c. Are there any logical flaws? Why are they flawed?
    d. Did he address opposing arguments? Which ones and how?
    e. What additional opposing arguments to the review can you think of?

BOOK REVIEW

Digital Image Processing, 4th Edition

William K. Pratt, 782 pp., ISBN 978-0-471-76777-0, John Wiley & Sons (2007), $125 hardcover.

Reviewed by James E. Adams, Jr., Eastman Kodak Company, Rochester, New York

The second edition of Pratt's *Digital Image Processing* has been a well-thumbed member of the reviewer's library for a number of years. As the author states in the preface to the fourth edition, this book is an "industrial strength" introduction to digital image processing. Collected in one place are discussions of most image processing topics, complete with extensive references to key papers in each arena. When asked to solve a new problem, or create a new solution for an old problem, the reviewer frequently starts with Pratt to see how others have previously addressed the topic. More interesting, perhaps, is the ability to review other seemingly unrelated topics in the chance to realize new linkages and synergies that can result in invention. The strength of *Digital Image Processing* in this regard is the easy accessibility of the text for the nonexpert on any given topic. Each subject is treated concisely with all the advanced details left to the cited references. One quickly gets the gist of the problem and its basic solutions. In short, this book provides a painless entry into the various arenas of digital image processing.

It is an inherent liability of any encyclopedic work that new important topics surface and beg for inclusion. This is the stated motivation for the subsequent editions of this book. Also new to the fourth edition is the PIKS Scientific API software supplied as a CD affixed to the back cover of the book. With interest in these updates, the reviewer decided to add the fourth edition to his library.

The book is divided into six parts. Part 1 on Continuous Image Characterization is largely the obligatory review of basic Fourier mathematics, the human visual system, and photometry and colorimetry. In keeping with the brief expositional tone of the book, one finds largely just an organized presentation of the essential results with references to the classic texts in the field such as Goodman's *Introduction to Fourier Optics* and Wyszecki and Stiles' *Color Science*. Part 2 on Digital Image Characterization discusses the meatier subjects (from a digital image processing perspective) of sampling theory, aliasing, and A/D quantization and how they relate to image capture. Both monochrome and color systems are addressed. In the latter case, the digital camera color filter array system is described with basic full-color reconstruction methods detailed.

The message of Part 3 on Discrete Two-Dimensional Processing is that working in the spatial domain is only one of many possible useful data representations. Most of the workhorse transforms in this field can be found here: Fourier, cosine, sine, Hartley, Hadamard, Haar, Daubechies, and Karhunen-Loeve. The corresponding concepts of convolution, superposition, and windowing are also discussed. Part 4 on Image Improvement focuses on the more primitive building blocks of an image processing chain. Here the reader will encounter topics such as histogram modification, noise cleaning, sharpening, and image resampling. Both perspectives of changing the image with and without regard to the original scene content are discussed at some length, e.g., do you sharpen the image to reflect the high-frequency content of the original scene or to simply meet some preference criterion?

Part 5 on Image Analysis begins the discussion of higher-order cognitive-type operations. Edge detection, feature extraction, and image segmentation take the center stage. These topics are supported by discussions of morphological processing and shape analysis. This is by far the largest section in the book, and represents a kind of culmination of all that has gone before. It is also, perhaps, the most valuable part of the book as its easy onramp presentation style makes entry into this complex and increasing important field of study inviting, rather than intimidating.

New to the fourth edition is Part 6 on Image Processing Software. This is essentially a documentation of the application programming interface for the Programmer's Imaging Kernel System (PIKS) image processing software. (Complimentary documentation is provided on the enclosed CD.) This software package consists of a binary library (no source provided) of functions that implement a great number of the image processing operations described throughout the book. Example source code in ANSI C is provided on the CD of main program calls to the library to perform such tasks as histogram equalization and Weiner filtering. There is also an MS-DOS command line executable on the CD that can be used to access the library in the form of a scripting language.

Having both the second edition and fourth editions for review purposes, it was disappointing to find that a number of typographical errors from the second edition are still present in the fourth edition. Indeed, it appears that while a great deal of attention was placed on adding new material and bringing the overall work up to date, correspondingly little effort was devoted to editing the existing material. Compounding this is the consensus of several readers of this book that it has more residual errors that most other well-established texts. Unfortunately, no errata seem to be available via the Internet.

The inclusion of the PIKS image processing software is a bit of a mystery. In the preface, the author says the software is provided for educational purposes and for industrial software development. It is true that removing the distraction of implementing basic image processing operations allows the student to focus on the more advanced topics such as image recognition. However, is it not equally important for the student to be educated by seeing the source code implementations of said basic operations? As for industrial software development, any midsize to large company will probably already have their own in-house image processing libraries and scripting languages with capabilities that go beyond the scope of the PIKS image processing software. Still, this software package could be a useful leg up for the smaller industrial organization.

Overall, *Digital Image Processing* maintains its status as one of the standard texts in the field. Its ongoing updating to remain current and relevant in the rapidly expanding field of digital image processing is both welcomed and valued.

James E. Adams, Jr. is a senior principal scientist in the Photographic Science and Technology Center at Kodak's Research Laboratories. He holds 30 US patents in the field of digital image processing, especially with regard to consumer and professional digital still cameras.