Stochastic Screening – Been There, Done That?

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Abstract

Since the early 90's and the introduction of desktop photo-imaging, error diffusion[1] has continued to be used as the primary FM screening method for photo-inkjet printing. Modern error diffusion algorithms continue to deliver stunning photo quality but the nature of the algorithm makes it calculation intensive and inherently slow. Much work has been done over the years to try and improve the performance of error diffusion. As a result of this work and modern hardware configurations, contemporary algorithms operate at significantly increased speeds (and image rendering quality) when compared to similar developments from the late 80's and early to mid 90's. The fact is though that however many optimisations are applied to the algorithm, a simple point process[2-5] system such as that employed with a threshold array will always exhibit better performance when compared with an equivalent error diffusion algorithm operating on the same image data.

Since the early 90's printer page speeds have increased. As a result of this advance in printing technology, attention has returned to the performance characteristics of halftoning and color matching as they have become more and more of a bottleneck to achieving the print speeds demanded by the modern user. Printer manufacturers have therefore continued to investigate alternative and faster methods of halftoning that could replace error diffusion. Simple look-up systems such as those employing stochastic threshold arrays have always delivered promising performance and improved print quality when compared with AM screens. Unfortunately they have also historically always failed to deliver sufficient print quality when compared with the error diffusion alternative. Images screened using such techniques have always tended to exhibit more visible dots and hence delivered coarser images than those produced by error diffusion. As a result, after considerable research and expense having been devoted to solving the problem, printer manufacturers have effectively shelved the idea and have been reluctant to re-visit it again.

Since those early forays into researching replacements to error diffusion, desktop printers have moved on significantly in terms of their hardware characteristics. Inkjet (and color laser) hardware technologies have now reached the point where extremely small dot sizes are the norm, color depths are increasing and dots are almost invisible to the naked eye. When you combine these vast technological leaps in printing with the huge advances in look-up halftoning algorithms, a viable alternative to error diffusion begins to emerge. This paper will seek to prove that given today's color inkjet printers, error diffusion is an unnecessary performance overhead and alternative methods of look-up based stochastic screening can in fact deliver the digital print quality and the print performance demanded by today's "educated" user.

Summary

Point process (look-up) halftoning systems have historically been unable to demonstrate equivalent print quality to error diffusion. The small dot size and semi-continuous tone characteristics of modern inkjet printers mean that look-up systems can now be considered as a viable alternative to error diffusion. This paper will demonstrate why this is so.

References

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Author Biography

Tony Harris is Chief Technical Officer and founder of Software Imaging, the dominant supplier of printer driver technologies to original equipment manufacturers (OEMs) world-wide. Mr Harris has been involved in print-imaging for over twenty years, holds patents in various fields, speaks regularly at imaging conferences around the world and has appeared on UK and USA television.