CMOS Image Sensor with Pseudorandom Pixel Placement For Jaggy Reduction in Line Representation

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Motivation

- Jaggy at edge
- Hard to eliminate the “perceived” jaggy
- High Vernier accuracy for step
- Insufficient by high resolution
Pseudorandom Pixel Placement

- Method for generating “Random” placement of Photo Receptor (active area)
- Array placement of 4 type pixels
Line Representation & Local Slope

By Lattice Placement

By Pseudorandom Placement

(small scatter steps)

Local slope $a = \frac{\Delta y}{\Delta x}$

Jaggy

= (Long) Periodical Step

= (Long) Periodical non-zero local slope
Spectrum of Local Slope

Standing Spectrum Factor = Jaggy

Lattice Placement

Pseudorandom Placement
Jaggy Appearance Index: Top/Other

- **Top/Other**
  - \[(\text{Strongest Factor}) / (\text{Avg. of Other Factors})\]
- How strong factor stands in spatial spectrum
- Large Top/Other = Strongly Perceived Jaggy
- Small Top/Other = Weakly Perceived Jaggy
Top/Other and Jaggy

Top/Other = 23.4

Top/Other = 6.6

Top/Other = 2.7
Numer of Pixel Types

☑ #Pixels for Pseudorandom Generation

- 4 Types
- 9 Types
- 16 Types
Top/Other / Pixel Types / Fill Factor

Best Top/Other in "4 types", for Fill Factor > 0.25
CMOS Image Sensor Design

- CMOS 0.18[um]
- #Pixels: 128 x 128
- Fill Factor: 25%
- #Pixel Types: 1, 4, 9
Conclusion

✓ Pseudorandom Pixel Placement for Jaggy Elimination
✓ Index for Perceived Jaggy, Top/Other
  ✓ Small Top/Other in 4 Types of Pixels
✓ CMOS Image Sensor with Pseudorandom Pixel Placement