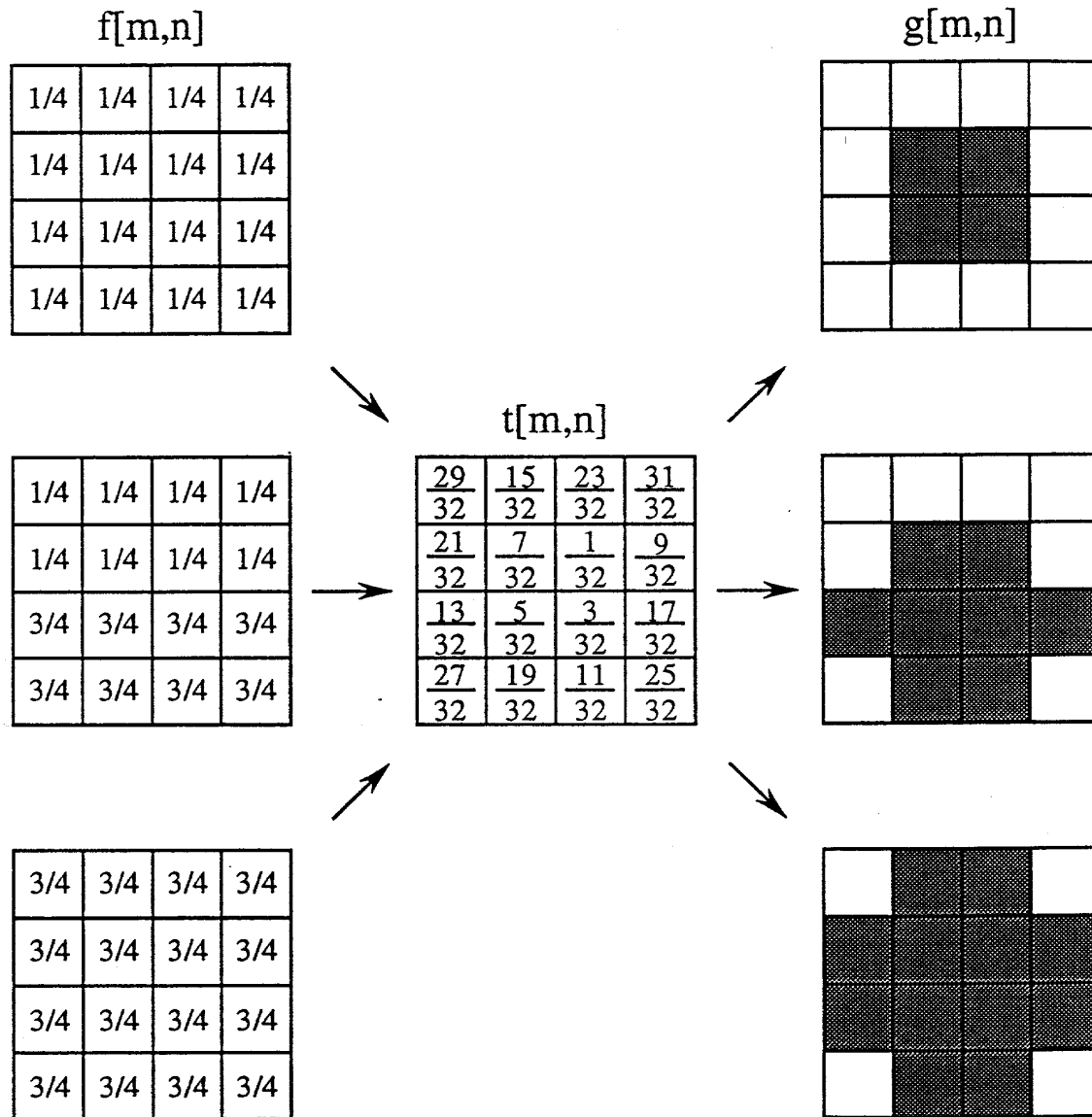


Partial Dotting



Recall Dual Representation

Index Matrix

3	2
1	4

$i[m,n]$

Threshold Matrix

$5/8$	$3/8$
$1/8$	$7/8$

$t[m,n] = (i[m,n] - 0.5)/MN$

• order that pixels turn "on"

Clustered Dot Screen

63	58	49	37	38	50	59	64
57	48	36	22	23	39	51	60
47	35	21	11	12	24	40	52
34	20	10	4	1	5	13	25
33	19	9	3	2	6	14	26
46	32	18	8	7	15	27	41
56	45	31	17	16	28	42	53
62	55	44	30	29	43	54	61

$i[m,n]$

- Consecutive thresholds are located in close spatial proximity.

Properties of Clustered Dot Screen

1. Relatively visible texture
2. Relatively poor detail rendition
3. Uniform texture across entire grayscale
4. Robust performance with non-ideal output devices
 - non-additive spot overlap
 - spot-to-spot variability
 - noise

Dispersed Dot Screen

Bayer's Optimum Index Matrix (1973)

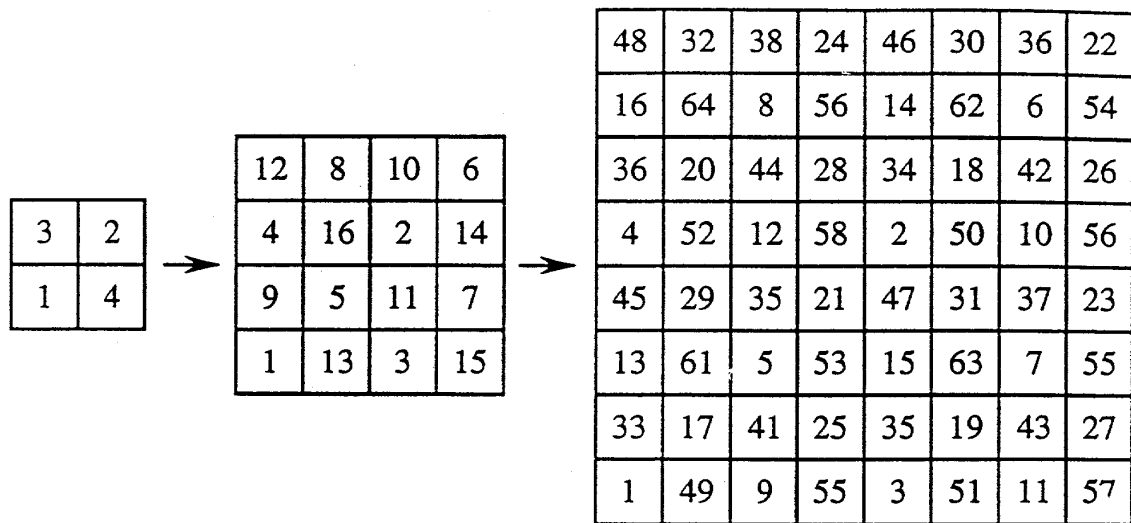
Recursive Definition (Judice, Jarvis, Ninke, 1974)

1. Let $i' [m,n]$ be any $M \times N$ index matrix
2. Define a new $2M \times 2N$ index matrix $i[m,n]$ as

$$i[m,n] = \begin{bmatrix} 4(i' [m,n] - 1) + 3 & | & 4(i' [m,n] - 1) + 2 \\ \hline 4(i' [m,n] - 1) + 1 & | & 4(i' [m,n] - 1) + 4 \end{bmatrix}$$

3. Recursively generate $2^K \times 2^K$ matrix starting with 1×1 index matrix [1].

Example



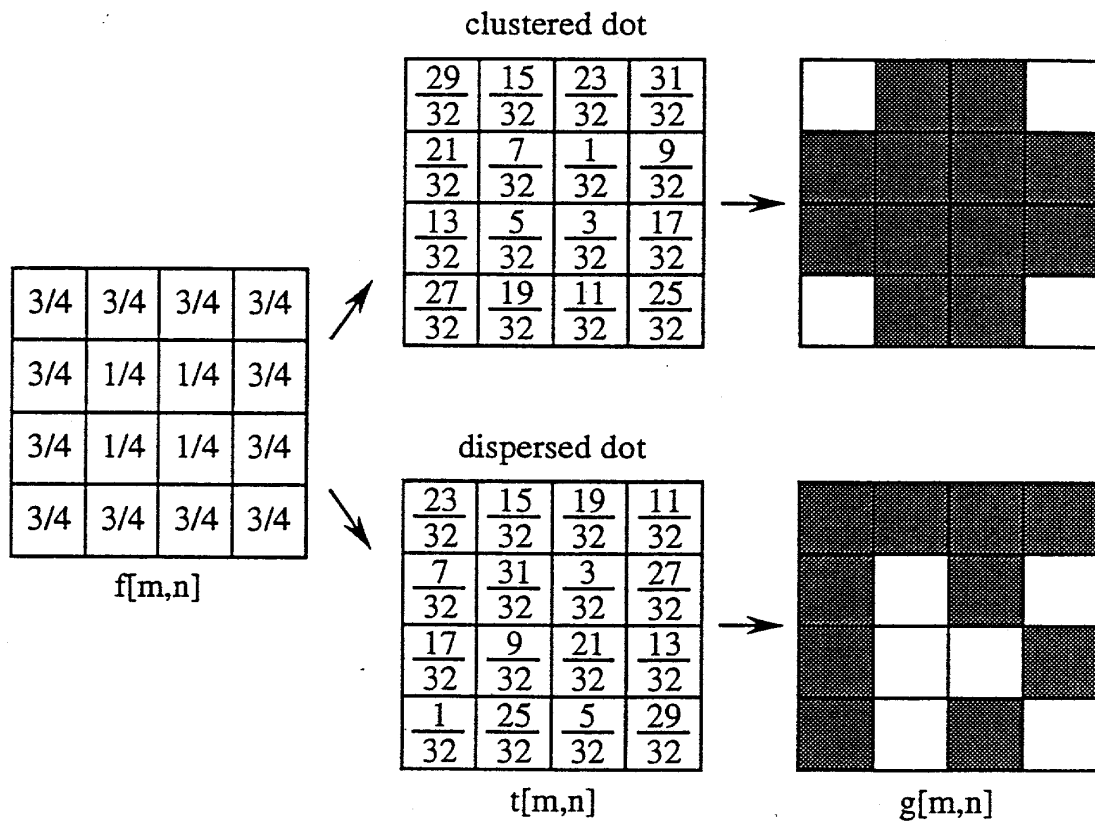
- Consecutive threshold are located far apart spatially.

Recursive Definition for Threshold Matrix

$$\begin{array}{c}
 \left[\begin{array}{c|c}
 t'[m,n] + \frac{0.5}{4MN} & t'[m,n] - \frac{0.5}{4MN} \\
 \hline
 t'[m,n] - \frac{1.5}{4MN} & t'[m,n] + \frac{1.5}{4MN}
 \end{array} \right] \\
 t[m,n]
 \end{array}$$

- Yields finer amplitude quantization over larger $(2M \times 2N)$ area.
- Retains good detail rendition within smaller $M \times N$ regions.

Example illustrating improved detail rendition with a dispersed dot screen



Properties of Dispersed Dot Screen

1. Within any region containing K dots, the K thresholds should be distributed as uniformly as possible between 0 and 1.
2. Textures used to represent individual gray levels have low visibility.
3. Improved detail rendition.
4. Transition between textures corresponding to different gray levels may be more visible.
5. Poor performance with non-ideal output devices

1-D Example

$$f[m] \equiv 0.25 \quad \tilde{f}[m] - \circ \quad g[m] - \square$$

