Modeling and Simulation of a Color Printer Pipeline

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Class Project : Literature Survey

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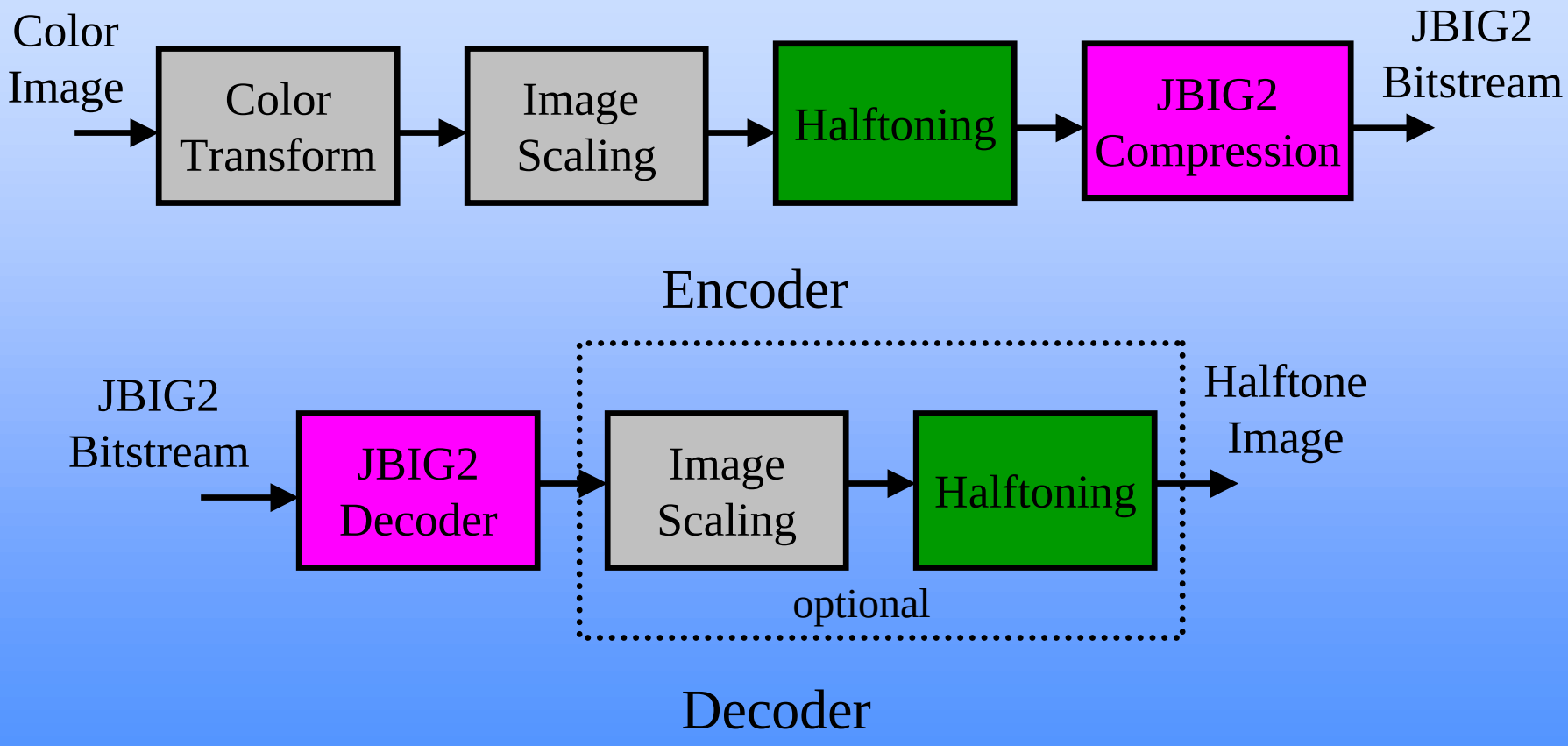
Introduction

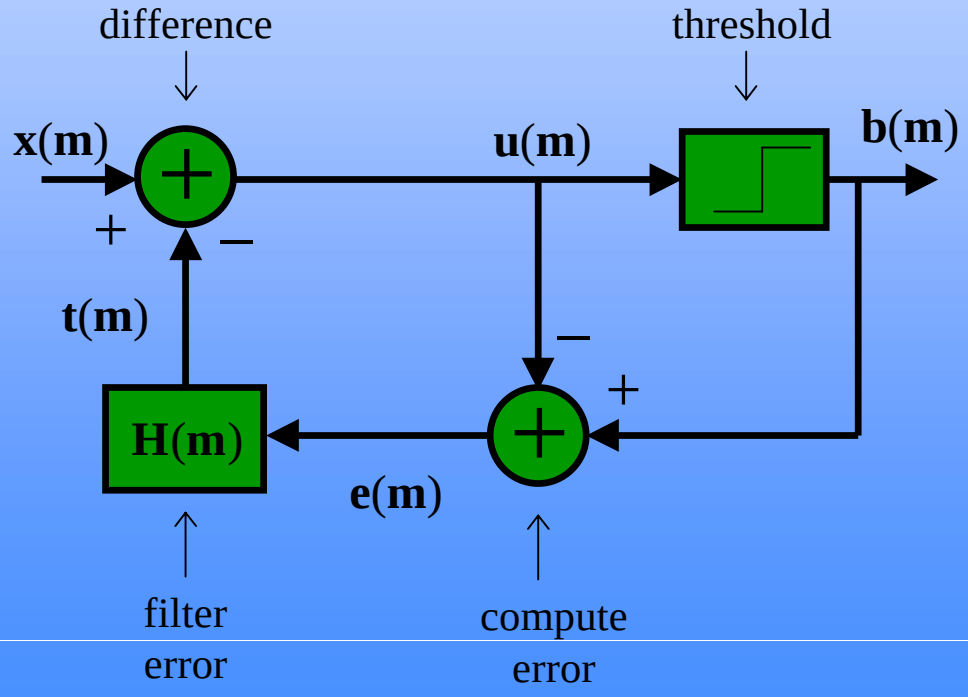
- Digital halftoning
  - Converts of a continuous tone image to a binary image
  - Creates the *illusion* of continuous tone
- Current halftoning methods (see handout)
  - Clustered dot dither
  - Dispersed dot dither
  - Error diffusion [Floyd and Steinberg, 1975]
  - Blue-noise mask [Mitsa and Parker, 1992]
  - Direct binary search [Analoui and Allebach, 1992]
  - Green-noise halftoning [Levien, 1993], [Lau, Arce and Gallagher, 1998]

Color Printer Pipeline



Vector Color Error Diffusion Halftoning

- Each pixel is a vector of color plane values (e.g. RGB)
- Error filter has matrix valued coefficients
- Adapt error filter coefficients [Akarun, Yardimci and Cetin 1997]



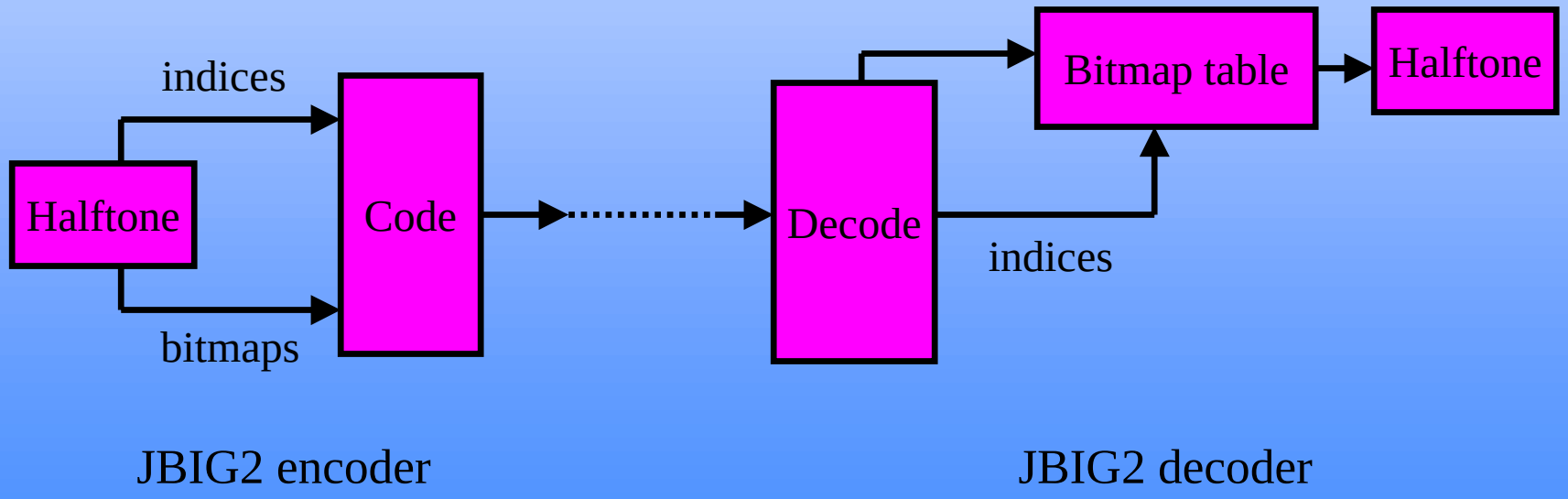
S Error filter support

$|S|$ Number of elements in S

$$\mathbf{t}(\mathbf{m}) = \mathbf{H}(\mathbf{m}) * \mathbf{e}(\mathbf{m}) = \sum_{\mathbf{k} \in S} \mathbf{H}(\mathbf{k})\mathbf{e}(\mathbf{m}-\mathbf{k})$$

The JBIG2 Halftone Codec

- The JBIG2 standard [Howard, Kossentini, Martins, Forchhammer and Rucklidge, 1998]
  - Allows lossy compression
  - Defines decoder behavior (encoder optimizations possible)
- Lossy halftone coding



Modeling

- Domain
  - Synchronous Data Flow (SDF), [Lee, 1987]
- Implementation
  - Ptolemy
  - Stars in C++/C
- Goal
  - Simulation and testing of printer pipelines
  - Typical optimizations
    - Optimize halftoning for compression [Wong, 1994]
    - Optimize encoder for a given decoder [Kam, Wong and Gray, 1999]
  - Measure coding rate and image quality tradeoffs