HYPERGRAPH-BASED IMAGE REPRESENTATION

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HYPERGRAPH-BASED IMAGE REPRESENTATION

• Paper begins with basic definitions:
  • Hypergraph, hyperedge, star, degree, etc.
  • Only considering undirected, connected, simple hypergraphs

• Image Adaptive Hypergraph Model:
  • Each pixel is a vertex, with adjacent pixels as its neighborhood
  • Vertices are connected in hypergraph if the difference in intensity (color, brightness, etc.) is below a calculated threshold
  • Applications in image processing are demonstrated
NOISE DETECTION / CANCELLATION

- With this representation, hyperedges with cardinality 1 are often noisy hyperedges.
- The paper describes an algorithm to detect such noisy hyperedges.
- This makes it easy to sample the surrounding pixels in order to correct the noise.

Fig. 2. Example of IANH-based noise detection and cancellation.
SEGMENTATION

- **Paper describes algorithm to partition image using hypergraph representation.**
- **Useful for image processing programs like the 'Warholizer,' which fills in similar areas of an image with solid colors.**

**Fig. 3.** Example of IANH-based image segmentation.
EDGE DETECTION

• With the help of some established algorithms, the paper details how to use the hypergraph representation to distinguish visible edges within an image.

• Useful for image processing and for object recognition.

Fig. 4. Example of IANH-based edge detection.
HYPERGRAPH-BASED IMAGE REPRESENTATION

• Curious how various filters/effects in Photoshop worked from a computer science standpoint

• I was also interested to learn that similar image representation is useful for 3-D object recognition