Techniques Towards Vectorization "introductory talk"

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Plan

1. Introduction
2. Vectorization Methods
3. Machine Drawing Understanding
4. Conclusion
5. Talk Introduction
6. Discussion Panel
7. Bibliography

Introduction 1/3

or, a chairman's personal definition of vectorization

- **Vectorization** = raster to vector = inference of « **unexisting** » information
- « Unexisting » means « **lost** »
  i.e. There's good hope the information was somewhere before *sampling, distorsion, noise scatter, blurring, data loss etc.* happened.
- Reminder: Wall & Danielsson ***1984***

Vectorization process is:

- **Presumption** of geometric primitives (lines, curves)
- **A priori** definition of set of acceptable **primitives**
- **A priori** definition of set of acceptable **deviations** from true shapes

A set of pixels forming acceptable primitives within the limits of the accepted deviations

Introduction 2/3

Deep Thoughts

- Is dealing with
  - Oversegmentation
  - Undersegmentation
  - Non-detection
  - False Alarms

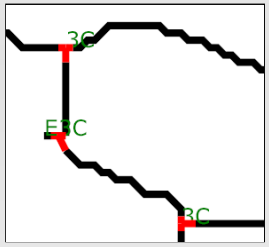
  ... still part of the vectorization process ?
- Is **vectorization** fundamentally different from **recognition** ?

Introduction 3/3

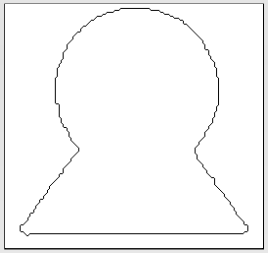
Typical Vectorization Plan

- Data reduction step
  - Segmentation
  - Gradient
  - Skeleton
- Model fitting
  - Hough
  - Bounding box
  - Parameter fitting (regression, Lmeds ...)
- Error quantification – thresholding – acceptation/rejection

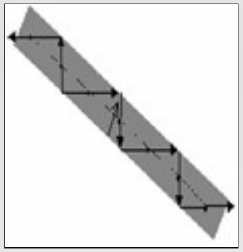
Vectorization Methods



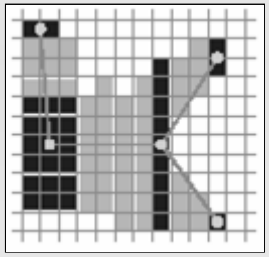
skeletonisation



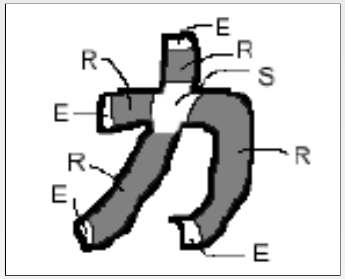
contouring



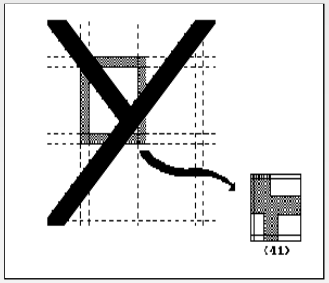
tracking



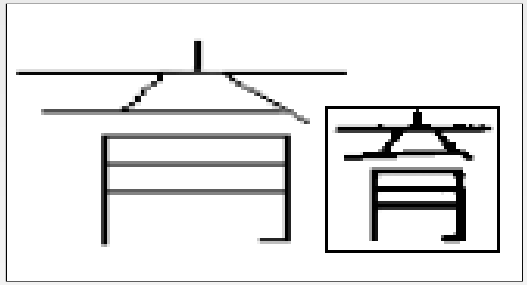
run



region



meshes

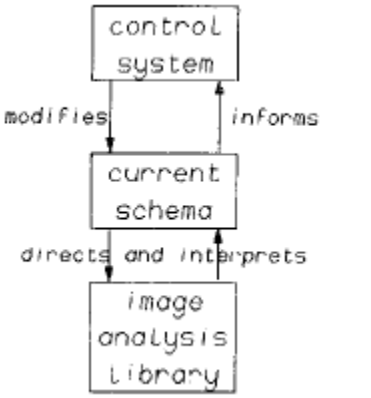


line transform

Machine Drawing Understanding

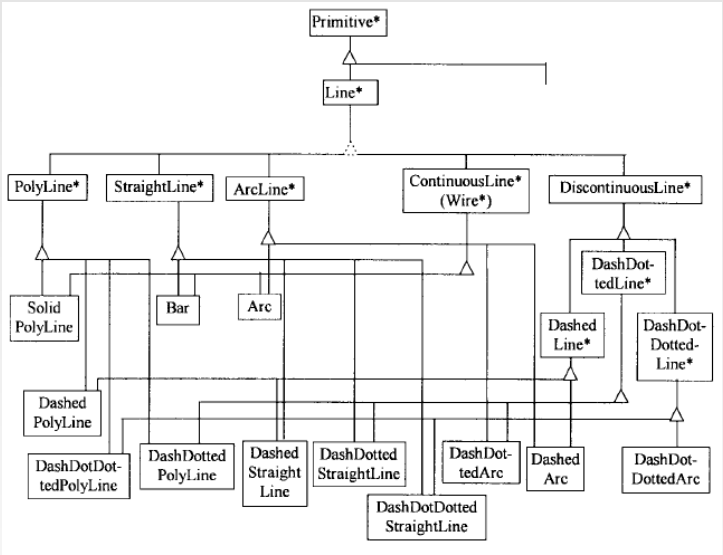
- Knowledge based Vectorization [Joseph'92] [Dori'99] [Couasnon'06]
  1. specific vectorization algorithm (bar, arc, curve, text, symbol, etc.)
  2. rule based interpretation

Joseph'92



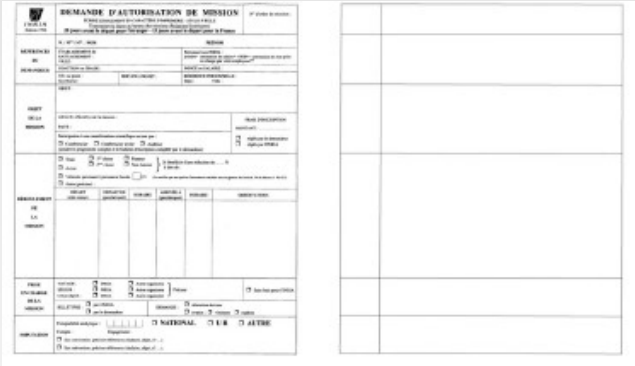
context-free grammar
perceptual cycle

Dori'99



object based representation
triggering recognition

Couasnon'06



2D extension of DC Grammar
terminal: line segment, pixel array

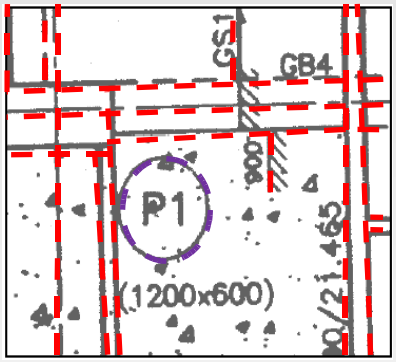
Machine Drawing Understanding

- Progressive object simplification [Song'02] [Ramel'04]
  1. specific vectorization algorithms (arc, bar, curve, text, symbol, etc.)
  2. object simplification

Song'02

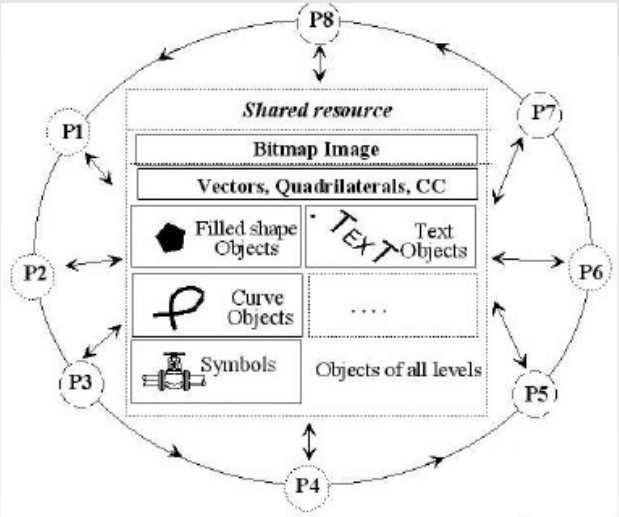
first step

second step



line tracking algorithm
simplification at image level

Ramel'04



contour based vectorization
simplification at vectorial level

Talk Introduction

" Detection of Circular Arcs in a Digital Image Using Chord and Sagitta Properties "
S. Bera, P. Bhowmick, BB. Bhattacharya"

*" G*OAL: Towards understanding of Graphic Objects from Architectural to Line drawings "
S. Pal, P. Bhowmick, A. Biswas, BB. Bhattacharya"

Automatic Road Vectorization of Raster Maps
"*YY. Chiang, CA. Knoblock"*

Robust Circular Arc Detection
"*B. Lamiroy, Y. Guebbas"*

Automatic Palette Identication of Colored Graphics
"*V. Lacroix"*

Discussion Panel (1/2)

"Detection of Circular Arcs in a Digital Image Using Chord and Sagitta Properties" *S. Bera, P. Bhowmick, BB. Bhattacharya*

Is it really useful to start with a complex mathematical framework (chord) and then admit significant deviations from the model to cope with discrete curves ? Wouldn't it be wiser just estimate the parameters from the data, and then take a decision on the confidence of the parameters ?

"GOAL: Towards understanding of Graphic Objects from Architectural to Line drawings" *S. Pal, P. Bhowmick, A. Biswas, BB. Bhattacharya*

- ✓ If you have some rotated text, like curve text in maps, is your text/graphics separation step affected?
- ✓ How the resolution of the images will affect your vectorization, especially the low resolution ones
- ✓ Do you have some split/merge procedures of the isothetic polygons, in the case of touching and broken objects in the images.

Discussion Panel (2/2)

"Automatic Road Vectorization of Raster Maps" *YY. Chiang, CA. Knoblock*

Can you explain the method to generate the color filter to extract the road layer, and the road layer itself ? What is the improvement provided by your method compared to these results?

"Robust Circular Arc Detection" *B. Lamiroy, Y. Guebbas*

"Automatic Palette Identication of Colored Graphics" *V. Lacroix*

- ✓ How is the result of the proposed method on images with lossy compression?
- ✓ For a large scanned image, the color palette usually varies from one region to another significantly due to the noise introduced in the scanning process and the quality of the original document, which makes it difficult to find a sub-image that contain every color used in the whole image. So, does the proposed method scale well if directly applied on a large image, such as the 10078 pixels by 6299 pixels scan map suggested in the paper ?
- ✓ How are the results compared to Mean-Shift color segmentation?
- ✓ Is the implementation of the work available for research purpose?

Bibliography

- ✓ S.H. Joseph & T.P. Pridmore. Knowledge-Directed Interpretation of Line Drawing Images. *Pattern Analysis and Machine Intelligence (PAMI)*, vol (14), vol (9), pp. 928-940 , 1992.
- ✓ D. Dori & L. Wenyin. Automated CAD Conversion with the Machine Drawing Understanding System : Concepts, Algorithms and Performances. *Transactions on Systems, Man and Cybernetics, part A : Systems and Humans (TSMCA)*, vol (29), vol (4), pp. 411-416 , 1999.
- ✓ B. Couasnon, “DMOS, a Generic Document Recognition Method: Application to Table Structure Analysis in a General and in a Specific Way,” International Journal on Document Analysis and Recognition (IJDAR), vol. 8 (2), pp. 111-122, 2006.
- ✓ J. Song; F. Su; C. Tai & S. Cai. An Object-Oriented Progressive-Simplification based Vectorization System for Engineering Drawings: Model, Algorithm and Performance. *Pattern Analysis and Machine Intelligence (PAMI)*, vol (24), vol (8), pp. 1048-1060 , 2002.
- ✓ J.Y. Ramel & N. Vincent. Strategies for Line Drawing Understanding. *Workshop on Graphics Recognition (GREC)* , *Lecture Notes in Computer Science (LNCS)*, vol (3088), pp. 1-12 , 2003.