Comparing Segmentations and Fractal Dimension Techniques for Automatic Quality Control on Textile Industry

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INTENTS:

- **comparison between: Fractal Dimension (FD) and Segmentation techniques for Automated Visual Inspection.**

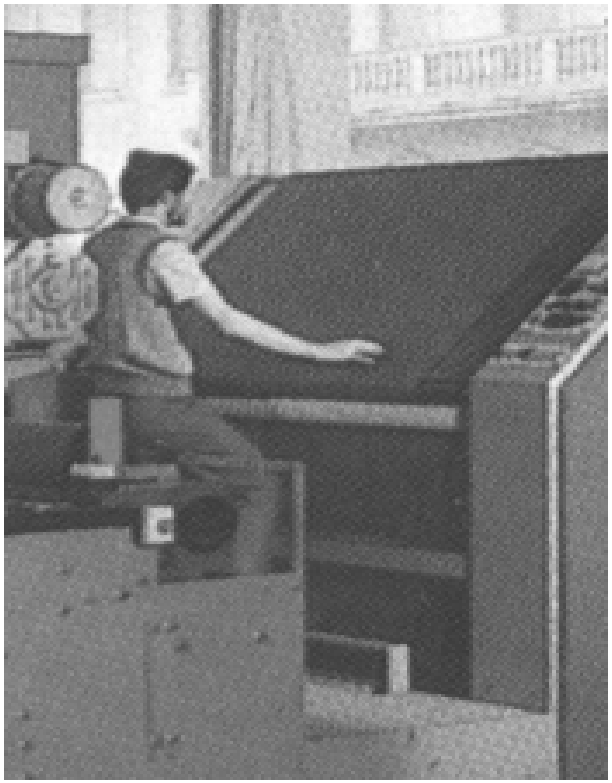
- **presentation of an implemented system for fabric manufacturing inspection.**

Importance:

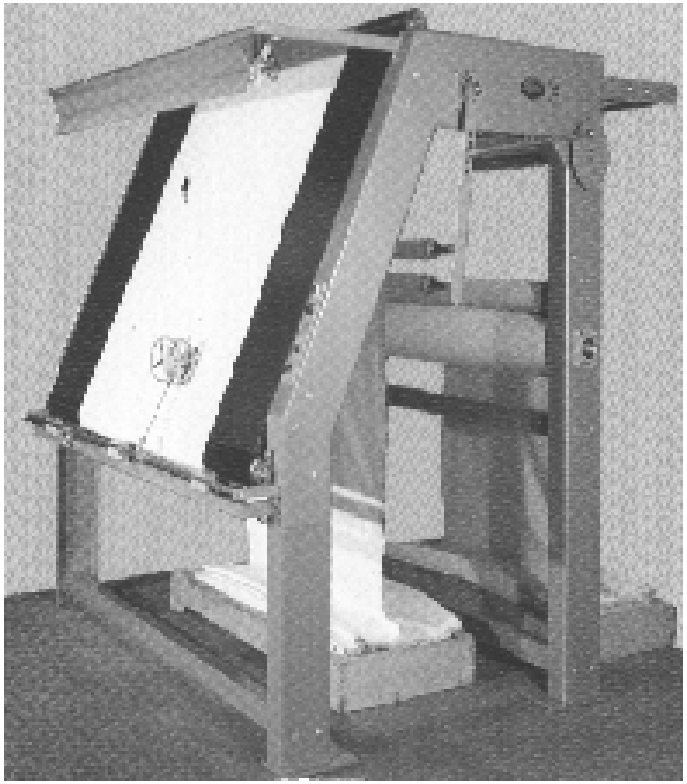
Visual inspection is an important part of quality control in the textile industry.

- Quality Control on Textile Industry : Changing from **human decision** based to a faster inspection using Automatic Visual Inspection (Machine Vision)

Manual Inspection = human eyes



a



b

Human Inspection:

- has been :
  - **time consuming** ,
  - **cost-intensive** , **and**
  - **due to the stress of the task, does not achieve a high degree of accuracy**.

Automated Visual Inspection

camera= image acquisition, **computer**=image analysis

Automated Visual Inspection :

- **a very high degree of product quality control.**

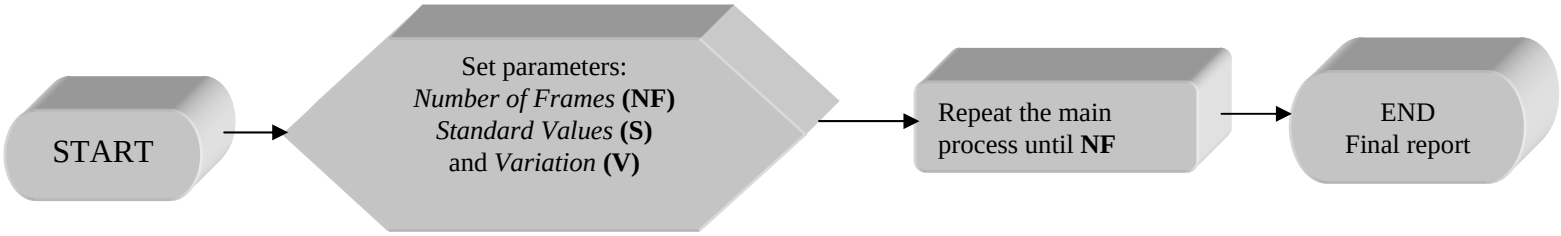
- but: **how quantify visual impressions in complex situation like those met in fabric manufacture**.

Main Dificulties:

- great variety and complexity of types of defects on textiles;
- industrial vision systems must operate in real-time;
- produce a low false alarm rate ;
- must be flexible so as to accommodate changes in the manufacturing process easily.

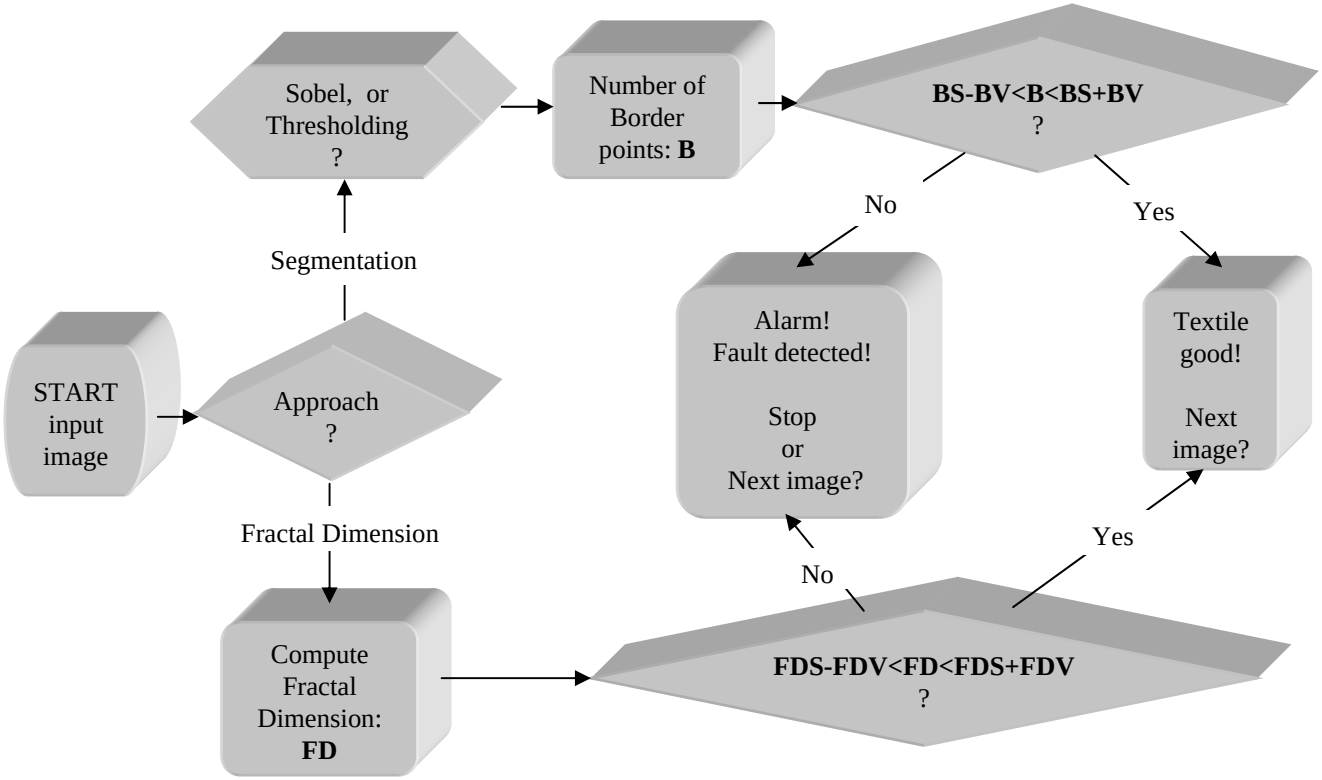
Implemented System :
Flowchart of global process

- implemented software



Implemented System :

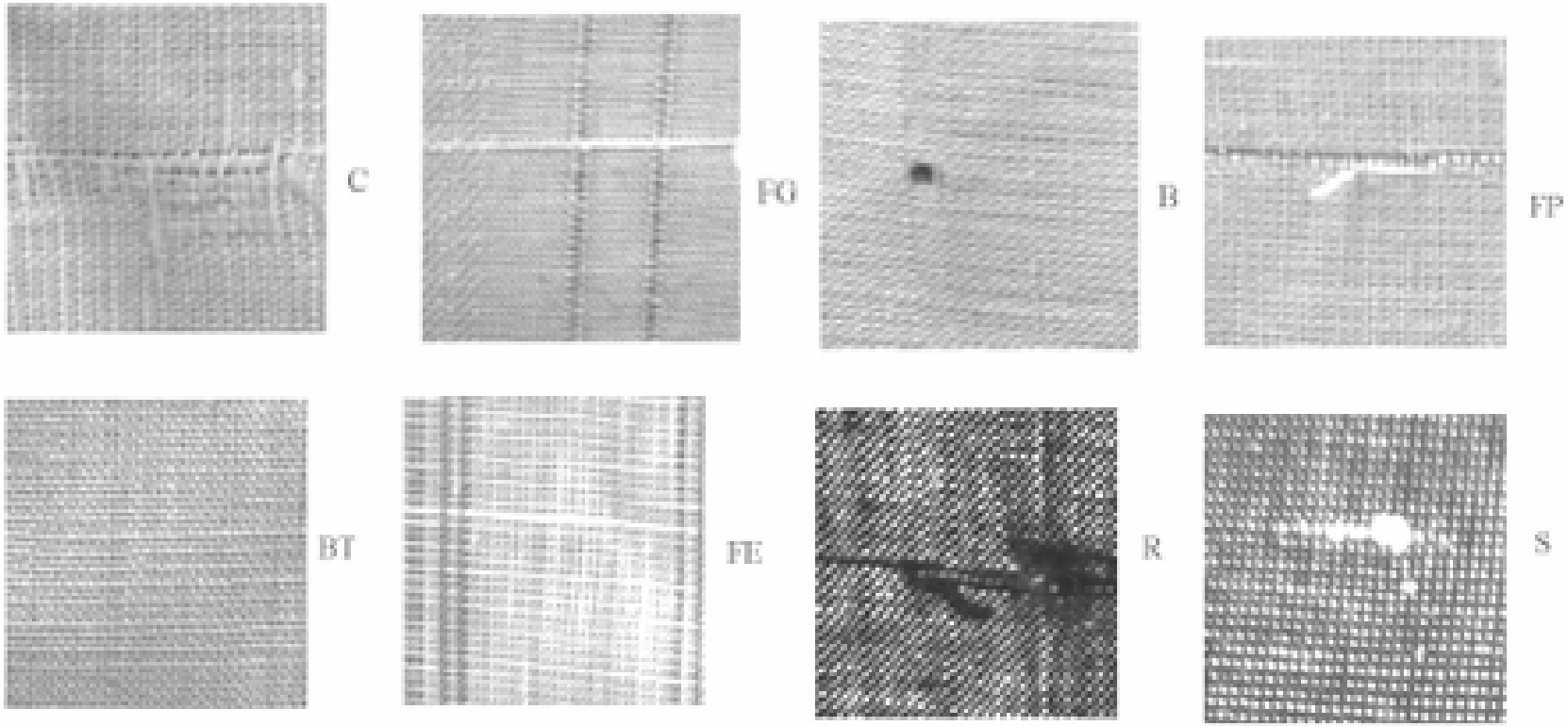
Flowchart of the main process



B Border points **BV** Border Variation**BS** Border Standard
FD Fractal Dimension**FDV** Fractal Dimension Variation**FDS** Fractal Dimension Standard

Types of defects tested:

C= "canaster"; **FG** = "bulky thread"; **B** ="gap" ; **FP** = "broken thread";
BT = "weaving strip" **FE** = "wrong thread" ; **R=** "draw back"; and **S**= "slub".

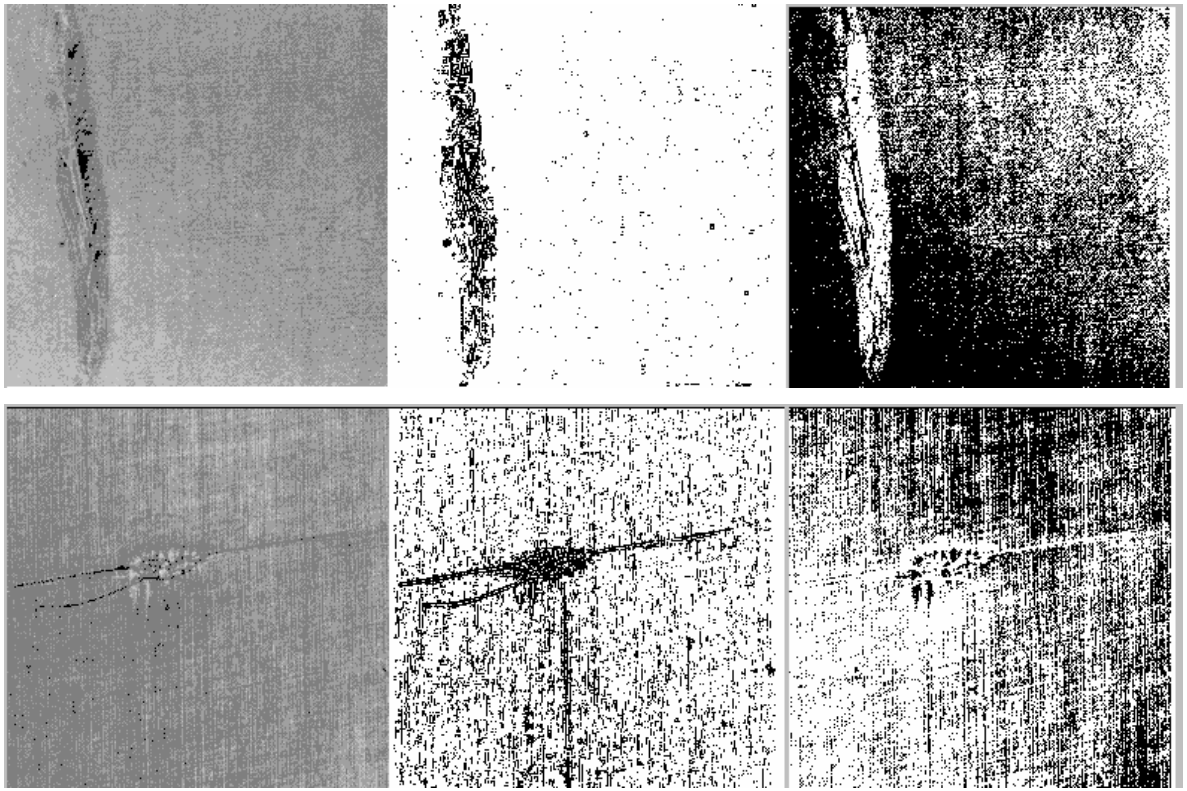


EVALUATION

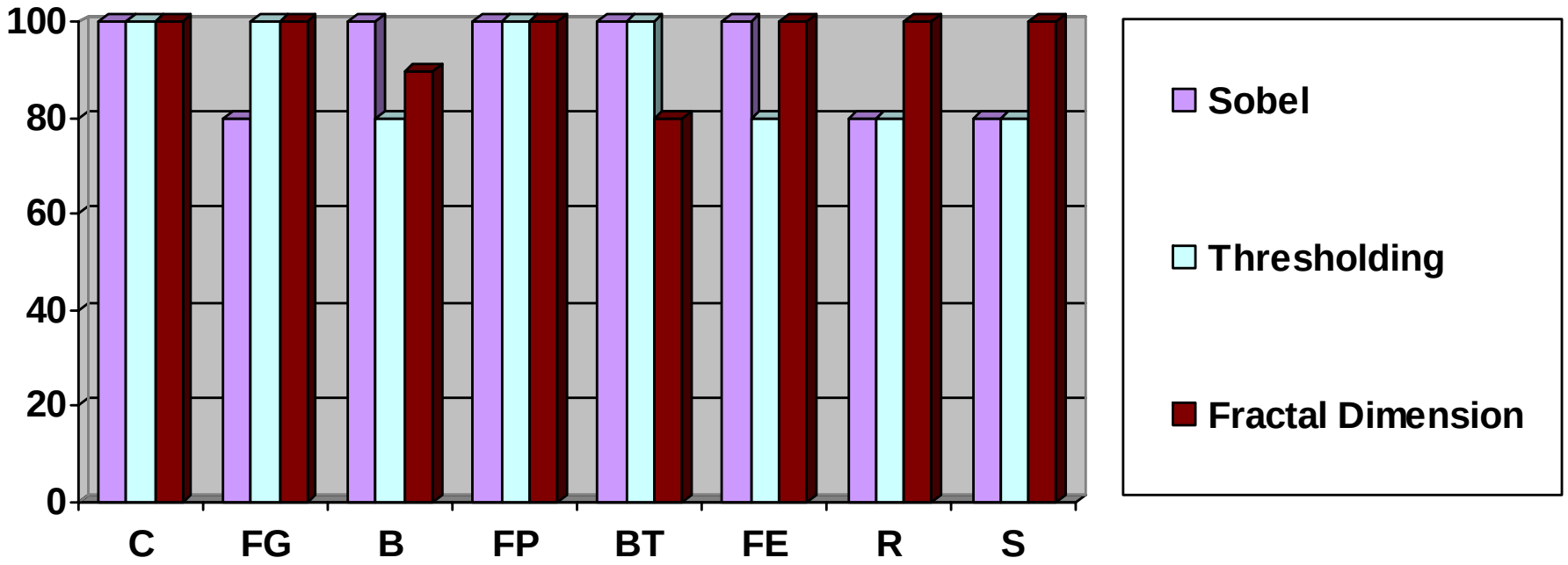
- **Experimentation was carry on using a C++ software .**
- **Two categories of image are used: with or without the types of defects tested.**
- **The same images were processed by all approaches.**
- **Ideal systems: must detect “100% of fabrics without defect” and “100% of the fabrics with faults”.**

How the System Work:

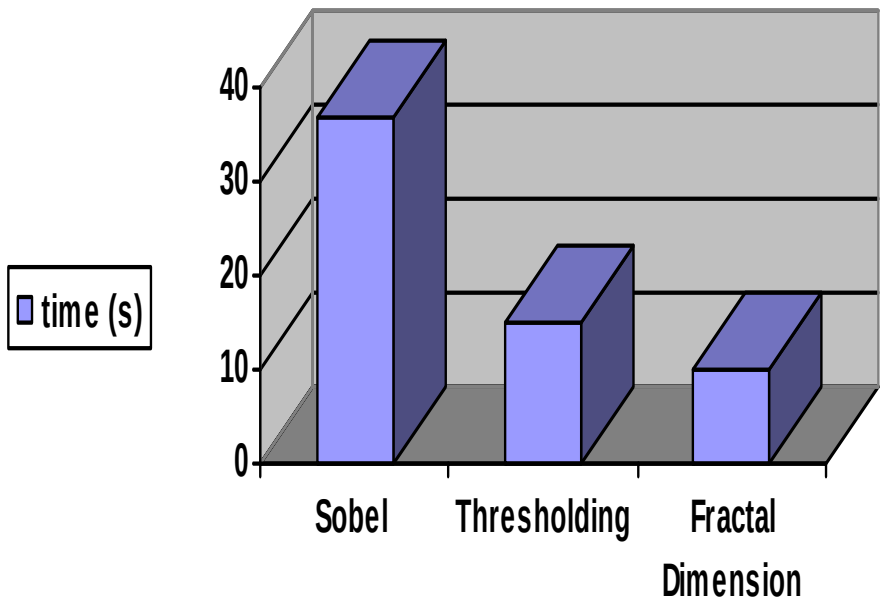
Original images (left), result of applying Edge Detection by Sobel (center) and threshoding operations (right column)



Results


100
80
60
40
20
0
C
FG
B
FP
BT
FE
R
S
Sobel
Thresholding
Fractal Dimension

Considering time of processing



CONCLUSIONS

- **the better approach for fail detection is related to the expected type of defects.**

- **the studied methodologies (Fractal Dimension, Edge Detection=Sobel or Thresholding) have showed a classification accuracy greater than 80% on average.**

- **the use of Fractal Dimension is 3.5 times faster than Edge Detection and presents better average results.**

- **the results show that Fractal Dimension is the most reliable method.**