

Mottling and graininess analysis

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Tapio Measurement Technologies Oy

Tapio Technologies — a company specializing in providing lab and online analyzers and analysis services for paper, board, tissue, plastic, printing, converting and nonwovens industries.

Our mission: We offer all paper, board, tissue, nonwovens and plastics mills worldwide with best analytical innovation. Tapio is known for its unique capability of connecting quality variations to production line elements causing these variations.

Location: Espoo: Finland

CEO: Tuomas Tiainen (tuomas.tiainen@tapiotechnologies.com)

Sales director: Ilkka Mustonen (ilkka.mustonen@tapiotechnologies.com)

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Tapio Measurement Technologies Oy

Products and services

- Paper Machine Analyzers
- Laboratory analysis services (troubleshooting, verification of QCS, calibration etc.)
- Roll Quality Profilers (hardness and moisture)
- Analytics software
- PapEye CloudQCS analytics platform for paper products www.papeye.com



papeye.com CloudQCS analytics platform

Online analytics platform for paper product quality analysis

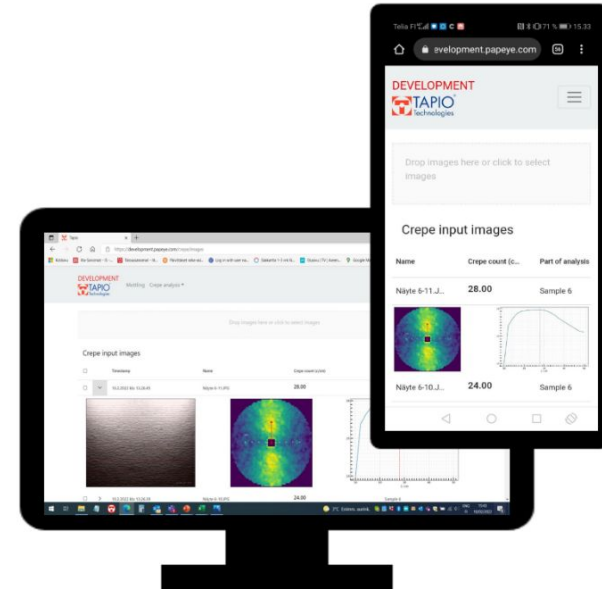
- SaaS, sold as yearly licenses to analysis modules
- Extremely easy to use
- Scalable software architecture
- Off-the-shelf products as sensors

Currently available analysis modules:

- Tissue crepe count analysis
- Print mottling
- Print graininess



powered by  aws



Definitions

Mottling: *Defect occurring in prints which has a negative influence on the perceived evenness of the print.*

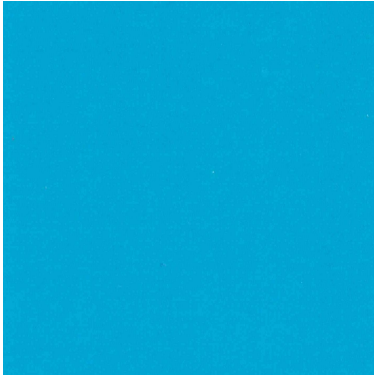
Graininess: *Fluctuations in the lightness of the printed sample, which causes inhomogeneity in the printed image while it is viewed under a homogeneous light source. [1]*

[1] B. Panahi, S. G. Kandi.: Introducing new methods based on the standard iso/IEC 24790 to evaluate graininess for coloured printed images

Procedure according to ISO/IEC 24790

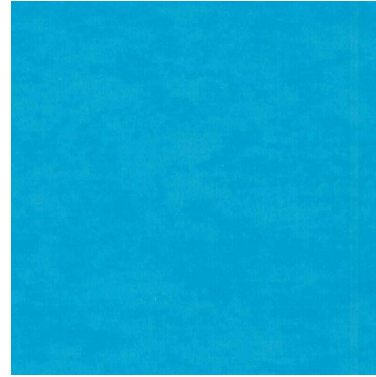
1. Obtain image and select homogeneous region of interest (min. 1x1 inch for mottling, 0.5x0.5 inch for graininess)
2. Convert image to grayscale with CIE index method
3. Apply 2-dimensional wavelet filter
4. Calculate variance of filtered image to obtain **mottling/graininess value**

Examples of mottling values



Good print quality

Mottling value 0.29



Worse print quality

Mottling value 1.34

Mottling values indicate variations in the print

Lower mottling values = better print quality.

Mottling vs graininess scale

Graininess: 0.3 to 1.47 1/mm

Wavelengths: 0.68 mm ... 3.3 mm

Table 2 — Frequency band of 6 wavelet levels

Scale level	Frequency band (cy/mm)	
5	23,6220 to 11,8110	High frequencies to be removed
4	11,8110 to 5,9055	
3	5,9055 to 2,9526	
2	2,9526 to 1,4763	
1	1,4763 to 0,7382	Frequencies for graininess
0	0,7382 to 0,3691	

Graininess

Mottling: 0.09 ... 0.37 1/mm

Wavelengths: 2.70 mm ... 25 mm

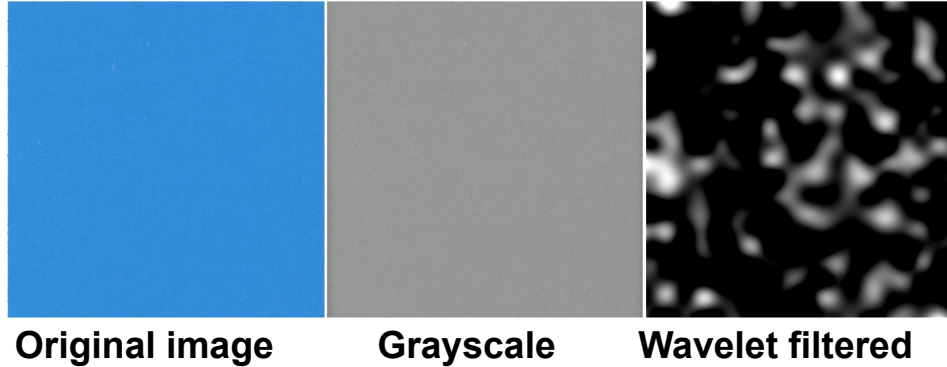
Table 3 — Frequency band of nine wavelet levels

Scale level	Frequency Band (cy/mm)	
8	23,6220 to 11,8110	High frequencies to be removed
7	11,8110 to 5,9055	
6	5,9055 to 2,9526	
5	2,9526 to 1,4763	
4	1,4763 to 0,7382	
3	0,7382 to 0,3691	
2	0,3691 to 0,1846	Frequencies for mottle
1	0,1846 to 0,0923	
0	0,0923 to 0,0461	

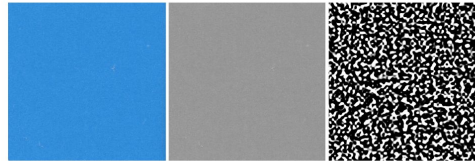
Mottling

Mottling and graininess analysis scale example

Mottling
1x1 inch



Graininess
0.5x0.5 inch

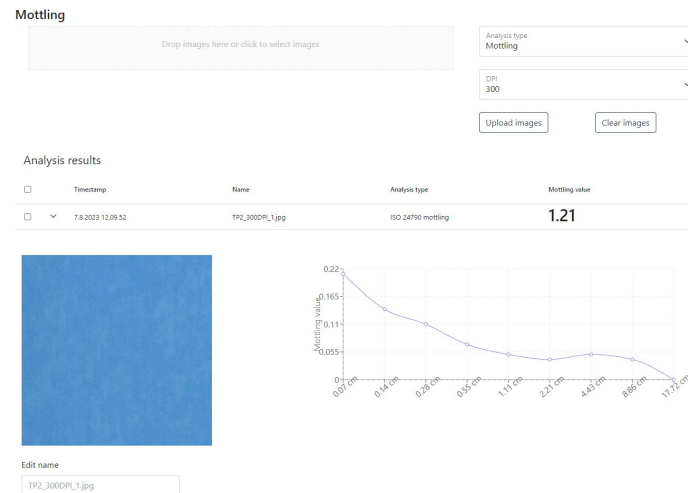
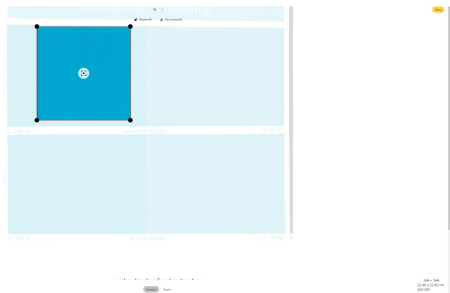


Images in scale with each other.

papeye.com Mottling and graininess analysis modules

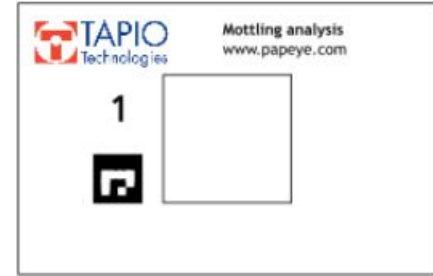
Upload and crop mottling/graininess images, analyze and export mottling/graininess values.

Crop tool for images.



papeye.com Mottling/Graininess automation features

- Automatic upload options
 - Upload by sending email to account-specific address
 - FTP upload
 - HTTP POST request to API
 - **Supported directly by many office scanners**
- Automatic crop options:
 - Markers in Tapio Mottling analysis cards
 - Markers in printed image
 - Based on location from image corner (fixed)
- Automatic naming of images based on barcode/marker present in image



papeye.com Template matching

- Automatic detection of analysis area based on detection of pre-configured template
- Allows for free rotation of the sample
- Multiple mottling analysis area possible



Example template

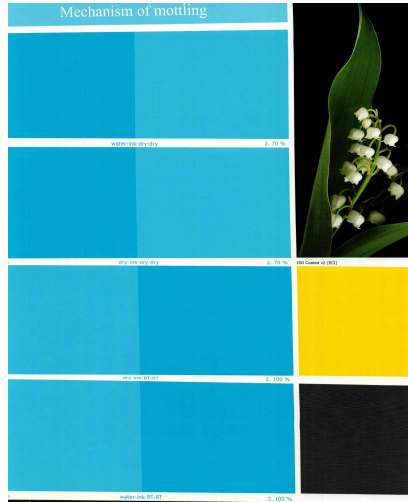
Detected template

Automatic selection of analysis area



Automatic detection of template and selection of mottling areas

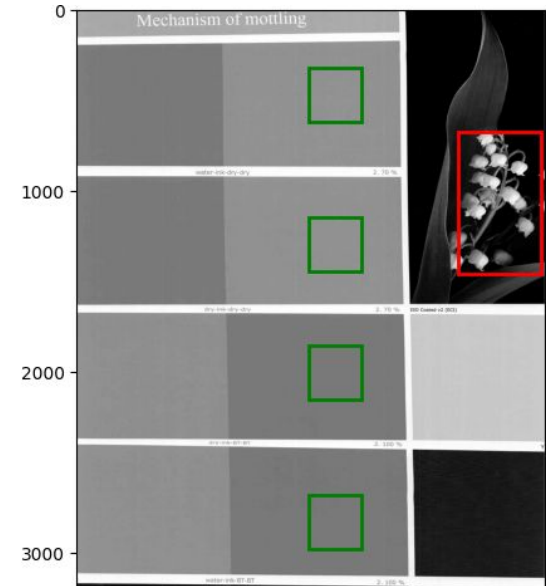
Template matching example



Input image



Template



Detected template
and mottling
analysis ROI's

papeye.com Mottling/Graininess export features

- Export to excel
- Access results with REST API

Api Root

PapEye REST API

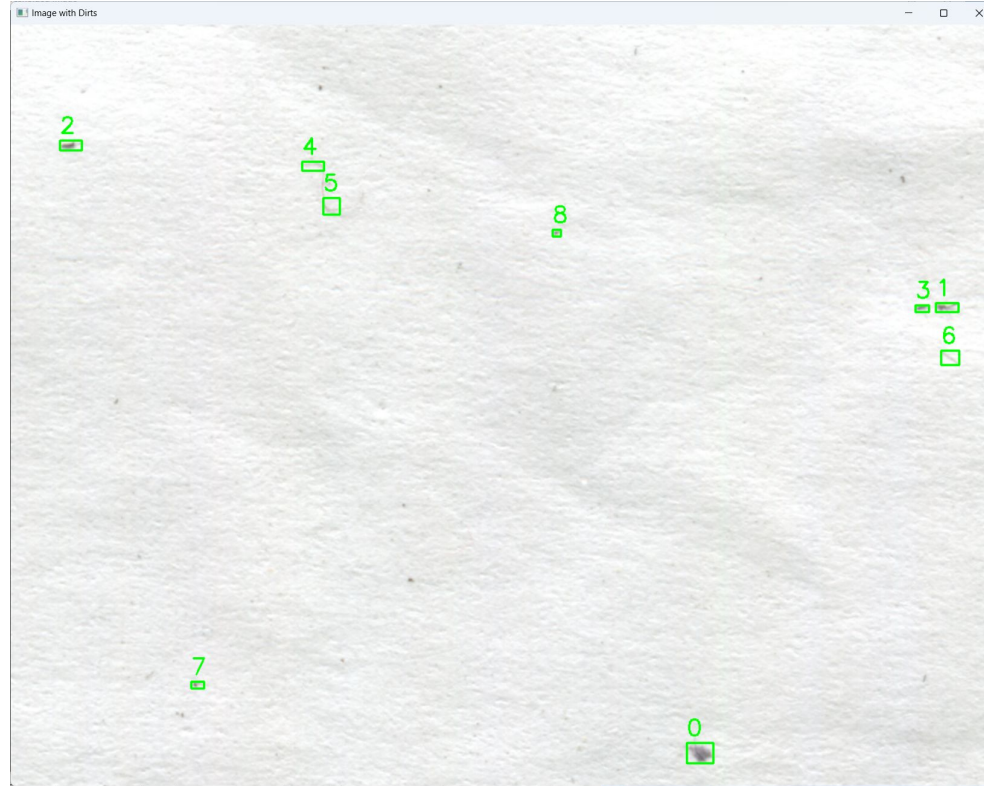
OPTIONS

GET

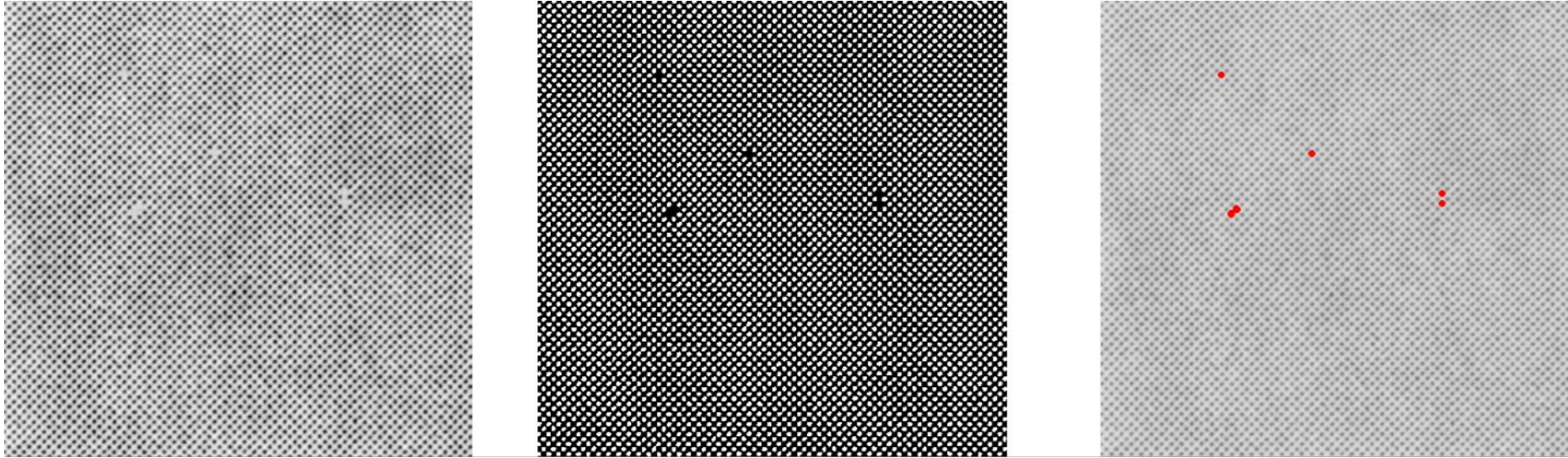


GET /api/v1/

Coming: Dirt count module



Coming: Missing dots module



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Sold as yearly licenses for modules.

Contact for trial/demo and sales:

info@tapiotechnologies.com