PROCESS MONITORING

Inline thermal distribution measurement of consolidation press tools using Python

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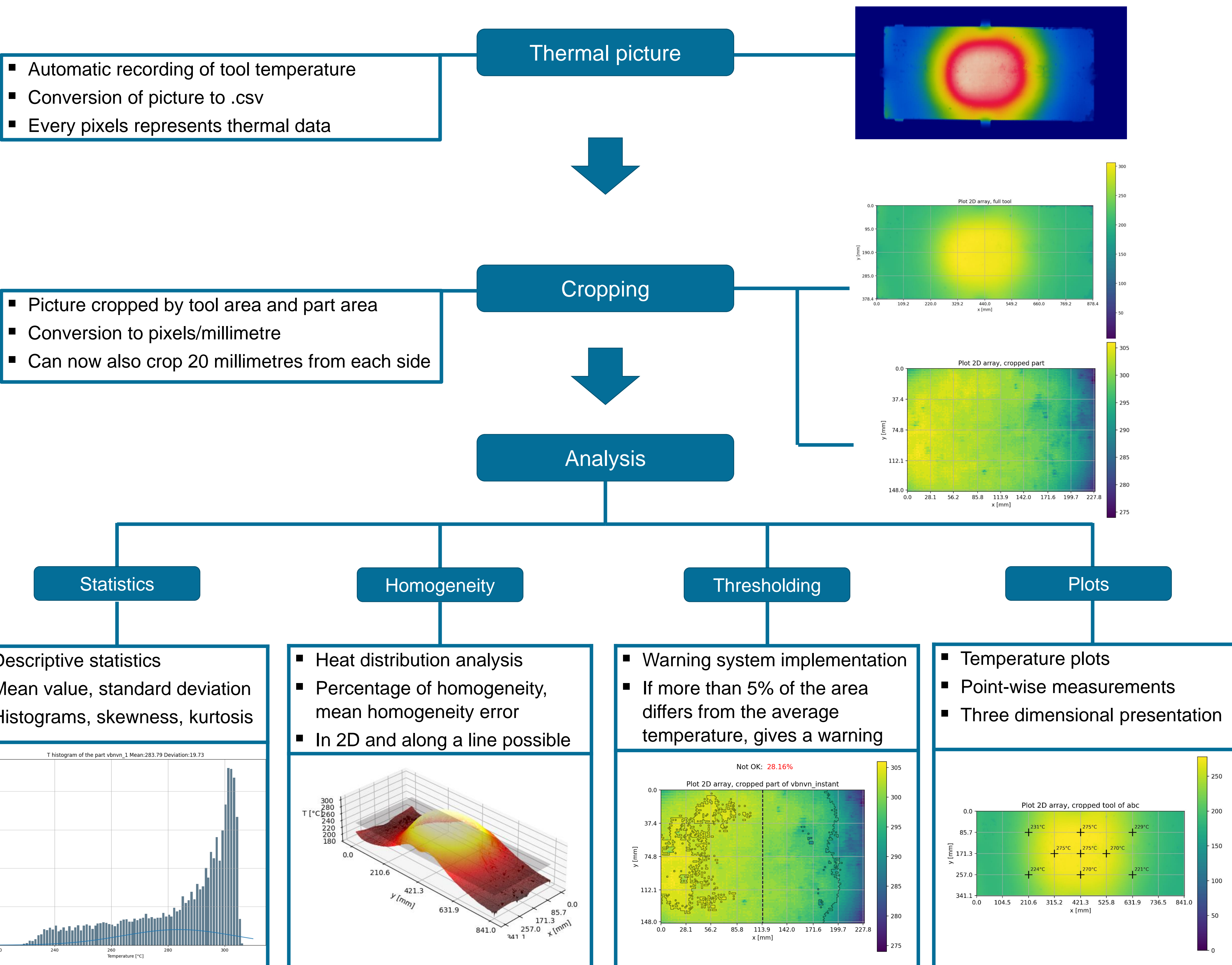
SCAN ME

Introduction

In a digital twin, one needs to collect, store, and analyse data that is coming from inline measurement systems. In the thermoplastic composite production line, a thermal camera is used to assess the temperature distribution of the tools of the consolidation press. If the temperature is not homogenous, the part inside the tools might show defects, such as unmelted areas or more void content. Therefore, it is necessary to analyse statistically the picture one gets from an infrared camera, so that it can be predicted whether the part after consolidation will have a good or bad quality. For this purpose, a Phyton code was created, which gives near immediate feedback on the temperature homogeneity of the consolidation press tools.

Experimental

Thermal picture

- Automatic recording of tool temperature
- Conversion of picture to .csv
- Every pixels represents thermal data

Cropping

- Picture cropped by tool area and part area
- Conversion to pixels/millimetre
- Can now also crop 20 millimetres from each side

Plot 2D array, full tool

Plot 2D array, cropped part

Analysis

Statistics

- Descriptive statistics
- Mean value, standard deviation
- Histograms, skewness, kurtosis

T histogram of the part vbnvn_1 Mean:283.79 Deviation:19.73

Homogeneity

- Heat distribution analysis
- Percentage of homogeneity, mean homogeneity error
- In 2D and along a line possible

Thresholding

- Warning system implementation
- If more than 5% of the area differs from the average temperature, gives a warning

Not OK: 28.16%
Plot 2D array, cropped part of vbnvn_instant

Plots

- Temperature plots
- Point-wise measurements
- Three dimensional presentation

Plot 2D array, cropped tool of abc

Summary

The Python codes written allow for rapid and flexible evaluation of thermographic pictures. Whatever inline measurement system generates an Excel sheet with rows and columns of data, the program can be used to evaluate the data, such as for example optical pictures.

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