FAKULTÄT FÜR !NFORMATIK
Faculty of Informatics

Diplomarbeitspräsentation

Interactive Variability Analysis for Initial Sample Testing of Industrial CT Data

Masterstudium:
Computergraphik / Digitale Bildverarbeitung

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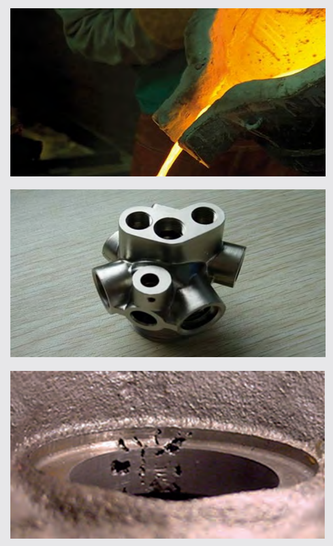
Motivation

Metal casting is a manufacturing process by which melt is poured into a mould and then allowed to solidify. The mould's cavity defines the shape of the produced casting. Due to the pouring process as well as during solidification *casting defects* (e.g. shrinkage, cavities, cracks) may appear that may influence the casting's mechanical properties and usability.

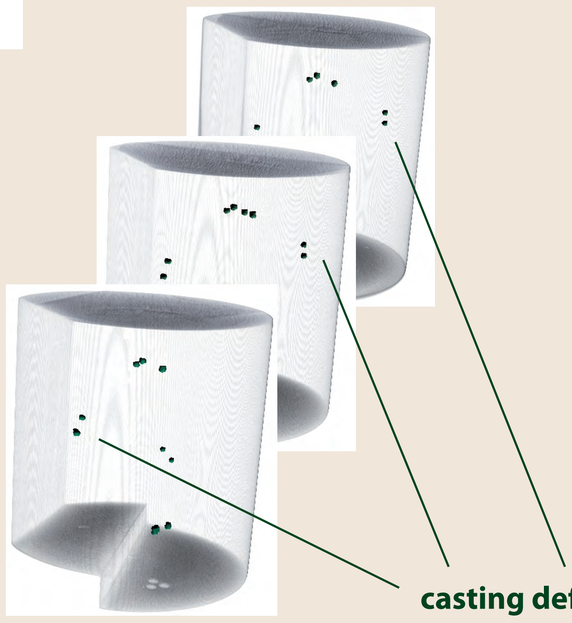


Constructing a new type of casting always requires the production of a *mould prototype* first. This new pattern has to be carefully tested for the occurance of casting defects before it can be released for serial production. During this evaluation step a series of initial samples is created using the new mould. By testing these samples, possible problems of the production process can be identified which may necessitate a change in certain process parameters (e.g. ventilation, melt temperatur, mould shape).

In the course of this master's thesis effort, a new approach for first article inspection has been developed. This evaluation pipeline explores a series of samples which are represented by industrial CT volumes. Using this pipeline investigations of the reliability of the production can be performed by analysing the recurrence of defects across a series of castings.

Variability Analysis Pipeline

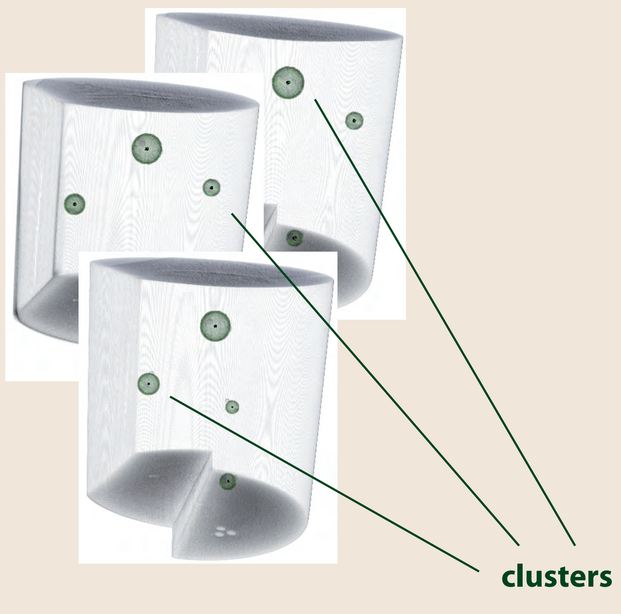
1



The initial data consists of a set of industrial CT data sets, representing castings that have been produced by the same mould.

Defect detection by segmentation is used to identify casting defects.

2



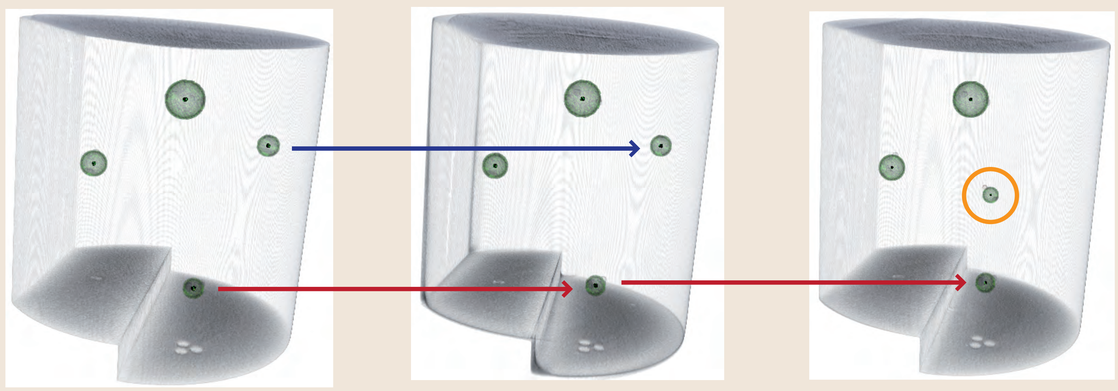
A clustering approach is applied onto the data.

This way not individual defects, but **regions of high defect concentration** are used for further calculations.

3

The clusters of the different castings are tracked across the series of volumes based on their spatial location. The occurance of clusters in the samples is counted to form the final result. Foundry engineers are especially interested in defective regions that appear in more than one casting.

yellow track:
cluster that appears in one sample casting only



blue track:
cluster that appears in two of three sample castings

red track:
cluster that appears in all sample castings

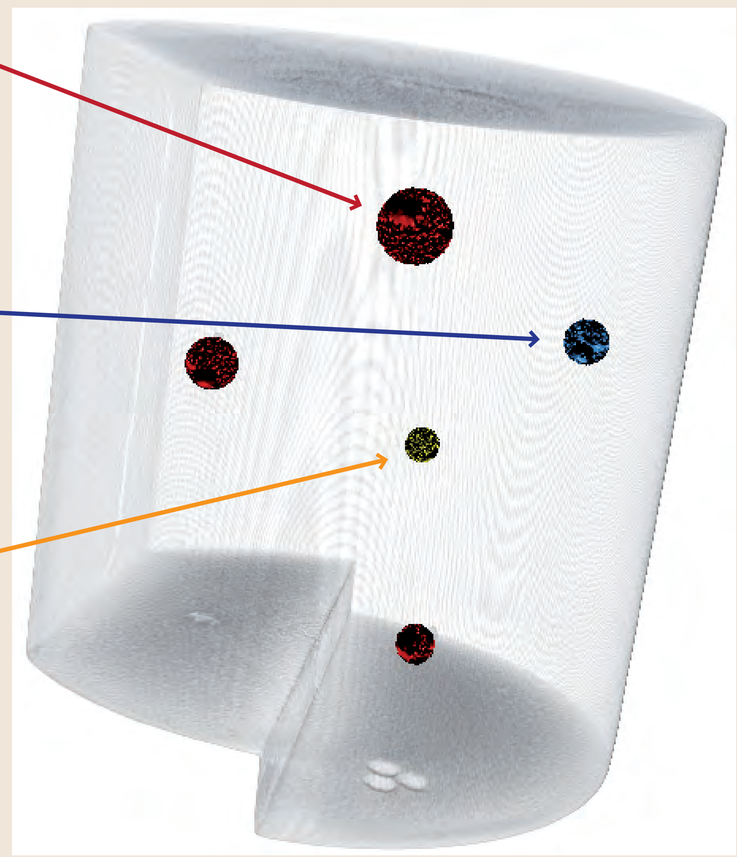
4

The information of the tracking paths is summarised to form the final result. The available cluster positions are marked in different colours, based on their occurance across the series of test castings.

red clusters:
mark regions of high defect concentration that appear in **all** sample castings

blue cluster:
marks region of high defect concentration that appears in **two** sample castings

yellow cluster:
marks region of high defect concentration that appears in **one** sample casting only



5

Evaluation: Based on the results, the foundry engineers will further analyse the red and blue regions in the new mould. Since these regions appear in more than one casting, the production process has a certain probability to produce defects in these parts.

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