TU Clausthal

Abschlussvortrag Masterarbeit Shravya Gogula

„Image Classification for the Characterization of the Progress of Glass Melting“

Glass is a widely used material across many industries and consumer products, including lenses, windows, electronics, automotive, and many more. It is a versatile material that fits needs in many applications.
To accelerate the glass development process, the platform MaterialDigital is an initiative to digitization in the Material Science industry. As part of this, the GlasDigital project focuses on accelerating the glass development process by automating the glass melting process with an automated robotic glass casting system and a machine vision camera.
The glass melting process is very complex, and it demands high expertise. In order to automate the glass melting process, it is essential to monitor the process. To achieve this, a machine vision camera is placed just above the furnace at a safe distance for live monitoring and data acquisition. The major challenge in the glass melting process is the glass melt overflowing. To avoid overflowing, we must monitor the amount of raw materials and the temperatures. Also, by monitoring the time required for the batch to melt, we can estimate how fast is the reaction and adjust the temperatures accordingly. Apart from avoiding the overflowing, the batch-to-melt times help us in achieving high throughput. To realize this system, we characterize the glass melting process images as it progresses and calculate the batch-to-melt times.
To control the reaction and avoid overflowing, we want to classify the glass melting images into three stages: granules, foaming, and glass melt. To achieve this, we propose fine-tuning the state-of-the-art pre-trained deep learning model, ResNet34, to classify the live image and an anomaly detection model based on reconstruction loss. Using transfer learning, the classification model is trained on 12 melting batches with various compositions, achieved 90% validation accuracy and
0.4 validation loss, and can classify the glass melt's general behaviour. The model performed well on a low viscous composition and was prone to make many transition errors on a high viscous composition. The classification model can be deployed to robotic casting system. The anomaly detection model failed to prevent the overflowing; it delayed by 13 seconds to detect the anomalies.

Betreuer der Arbeit:	Prof. Dr. Steffen Herbold, Prof. Dr. Joachim Deubener (Institut für Nichtmetallische Werkstoffe)
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Ort:	Online-Meeting über BBB
	Link: https://webconf.tu-clausthal.de/b/sim-uc9-rvy