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Publication date:
2018

Document Version
Publisher's PDF, also known as Version of record

Grand Solutions

Augmented Cellular Meat Production (ACMP)

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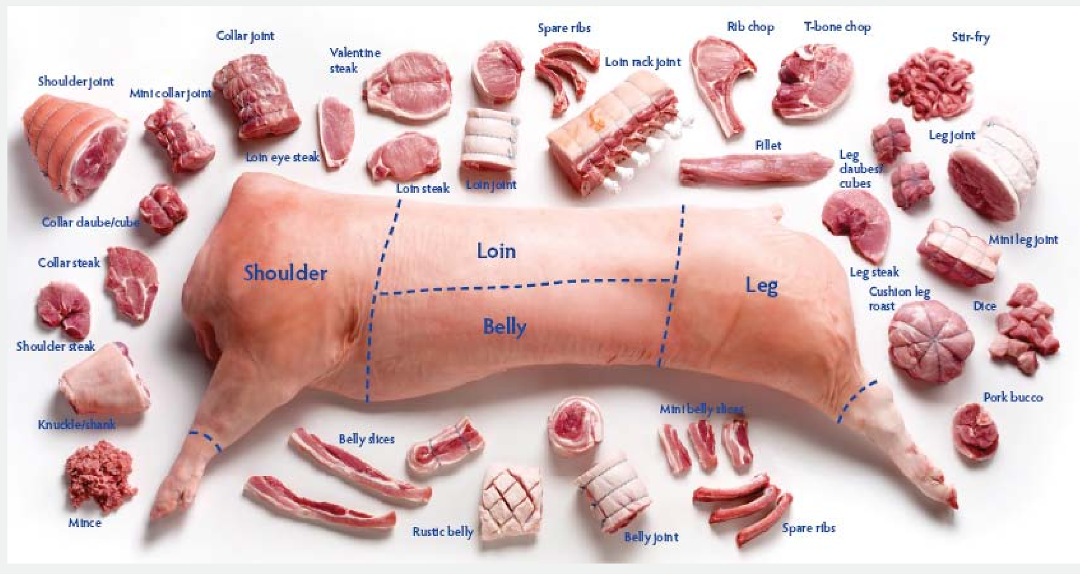
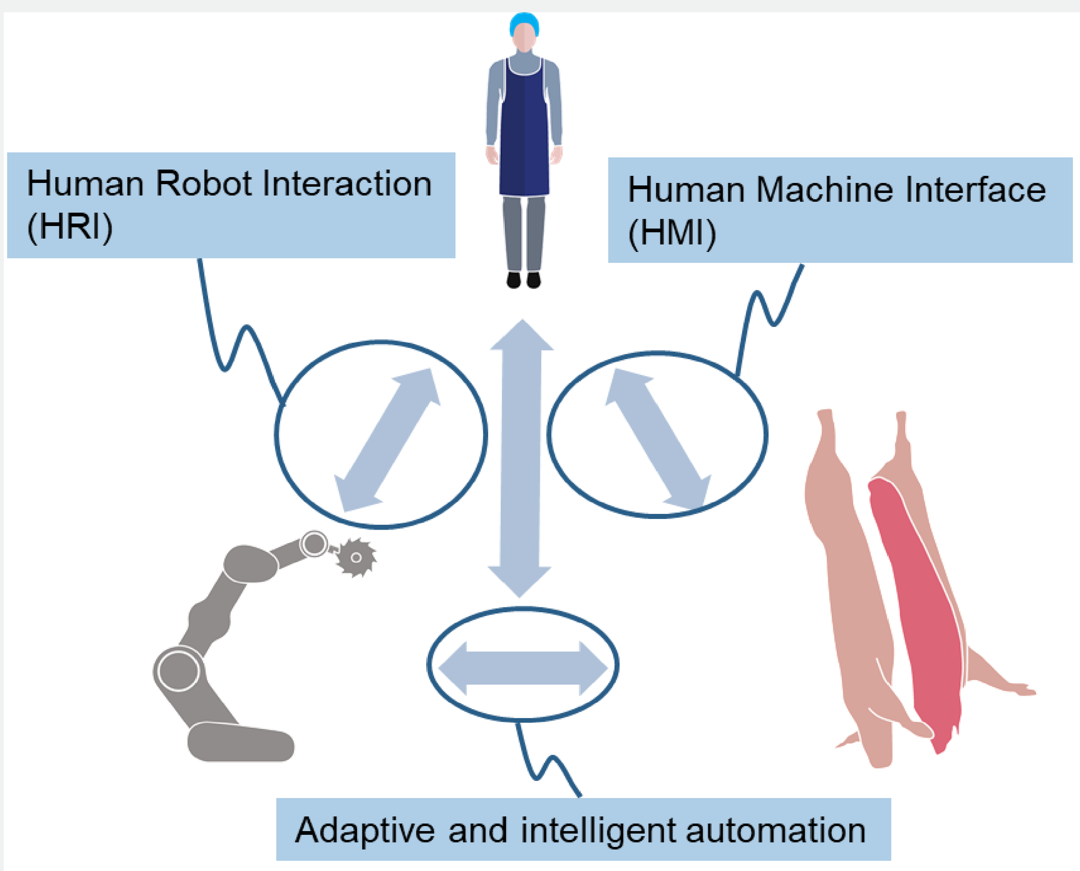
A collaborative robot cell concept as an alternative to the serial production line currently used in major slaughterhouses.



The aim of the project is to develop a new adaptive production concept where robot and operator collaborate in a cellular layout. The robot learns to adapt to the biological diversity from detailed measurements of the input and the process, as well as feedback from the operator.

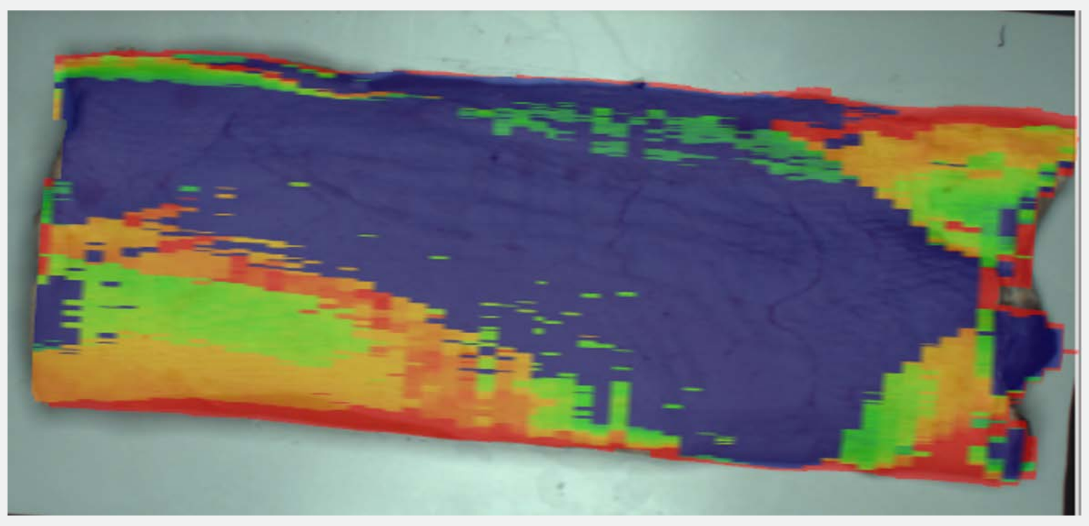


The collaboration between operator and robot is based on the development of a Human-Robot-Interface (HRI), which allows the robot to share its intentions, augment the operator's perception, by relaying processed information extracted from an array of sensors, and enables the operator to guide and instruct the robot.

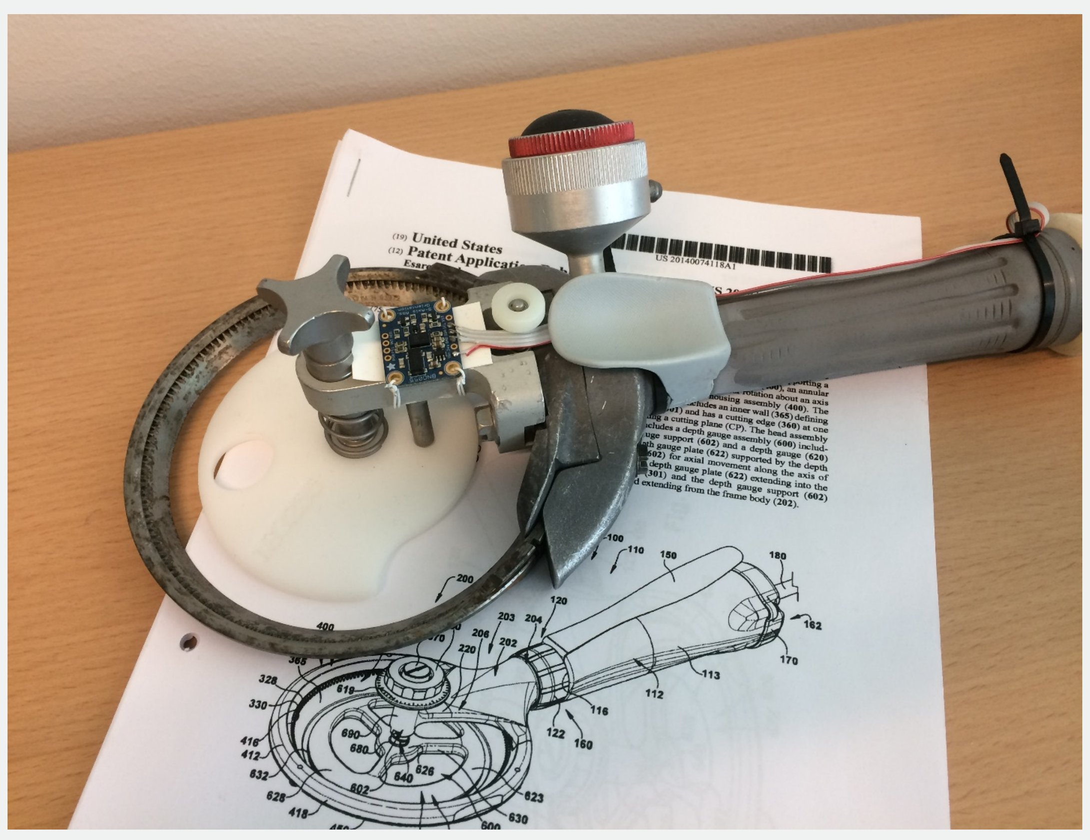
The connection between the operator and the machine is based on a Human Machine Interface (HMI), which in this case works through augmented reality. This means that the operator will have detailed information displayed directly on the meat that needs to be processed.

Belly trimming with handling assistance

In order to reduce the strain on the operator a robot will assist with the most tough parts of processing belly meat. The robot grips belly products from an intermediate storage and present each one to the operator. Trimming recipes for the specific products are visualized using HMI. The HMI works in this case via augmented reality, where the operator is wearing a set of HoloLens glasses.



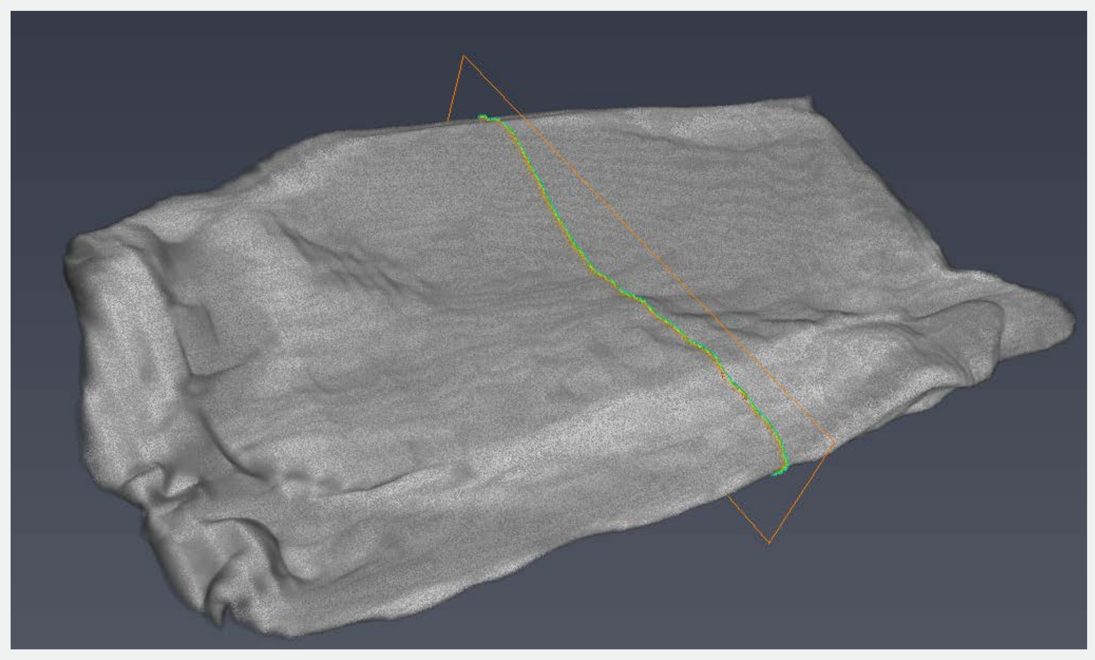
The augmented reality information of the fat layer thickness is shown to the operator as a colored fat contour in the HMI display and will guide the operator in where the belly should be trimmed. In a previous experiment a yield improvement in the order of 7-10% was demonstrated.



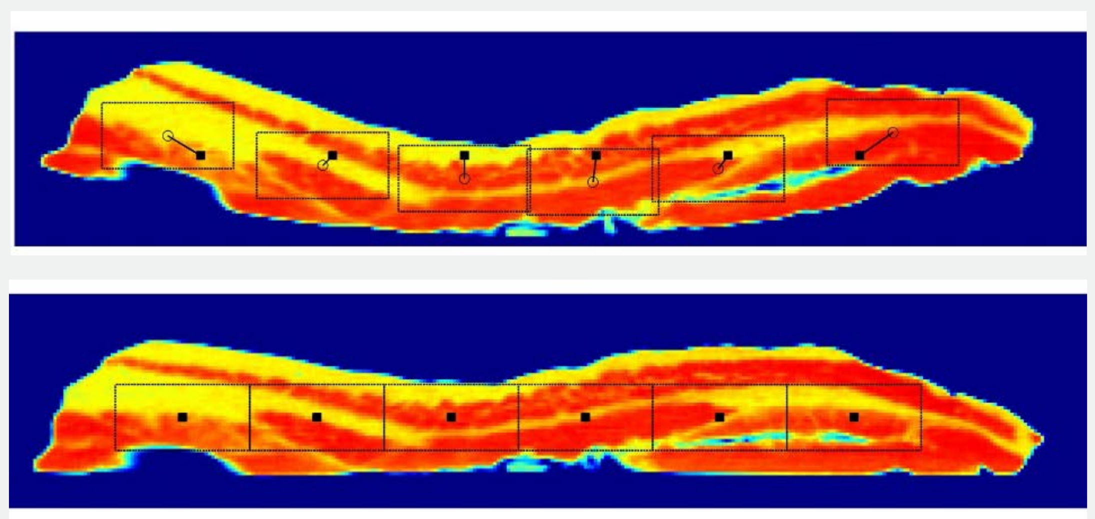
Feedback from the cutting process is achieved via a digital cutting knife, sharing the information of spatial position and thickness of the removed fat layer.

CT scanning, DVC and numerical simulations

The internal fat distribution of the belly is found through 3D computed tomography (CT) scanning, where the overall geometry and the distribution of meat constituents, such as tissue and fat is characterized. Since the CT scan is performed where the belly is lying in a curved position, a mapping of the internal structures at the position of the cutting process is performed.



Mapping between the original CT scan and the geometry presented to the operator through HMI is achieved with help from biomechanical modeling.



Digital Volume Correlation (DVC) is used in order to get the deformation field (mapping) between the belly geometry in the curved and flat state. This is used for adjustment and verification of the numerical finite element simulations. The two figures above show initial results in terms of mapping of a 2D cross-section of a belly including the contours indicating the Hounsfield scale, which is used to distinguish the different soft tissue constituents.

The ACMP project is running from November 2017 to October 2021

Total project expenditure: 32 mio. (IFD investment = 19 mio.)

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