

Smart Verification

Smart Verification Technologies for Meat Processing

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Project Description

The Australian red meat processing industry is Australia's largest agriculture/manufacturing sector, largest Agricultural export industry and largest regional employer. Costs associated with conducting business should be assessed and where possible reduced to ensure Australia remains competitive on a global scale. The 2020/2021 Federal Budget announcement of \$328M to be spent on "Busting Congestion for Agricultural Exporters" is validation these issues should be a priority. In particular, \$10.9M was allocated for building a more competitive and modern meat industry.

The adoption of 'smart' solutions such as AI cameras and smart glasses is one approach that can reduce compliance costs which are a significant burden on the industry. Smart technologies enable the remote or autonomous inspection of a meat processing facility and can yield significant gains in productivity, efficiency, and risk mitigation. However, it is known that this goal is very complex, expensive and could take time. Bondi Labs, in collaboration with over 20 meat processors, domestic and international auditing agencies investigated how two key technological approaches could be used. This report outlines the research teams activities and outputs conducted over six months (May to October) 2021.

Project Content

The purpose of this project was to explore a range of problem areas that could be addressed by continuous verification and remote inspection technologies. The project contained many diverse activities and deliverables. In summary:

Continuous Verification

- ✂ Built a mobile AI camera prototype
- ✂ Built a local and remote monitor website for viewing detection results
- ✂ Tested and evaluated in the field
- ✂ Researched other use cases for AI detection e.g. autonomous carcass contaminant detection
- ✂ Developed innovative research production methods using 3d digital twin, 3d printing and remote inspection technologies

Remote Inspection

- ✂ Built new features into the remote inspection software platform
- ✂ Rolled or continued support of smart glasses hardware/software solution to over 20 organisations
- ✂ Monitored and evaluated remote inspections and real audits
- ✂ Developed innovative cyber security features to increase the cost of an attack on audit data

Project Outcome

Continuous Verification

The research team was able to successfully build an AI camera prototype solution called the Box Label Verification (BLV) system. The prototype rig includes two camera sensors that can be positioned at different angles near a conveyer belt, capturing data and storing it to either a local edge device or to the cloud. This hardware solution can be repurposed to perform other data collection, or camera capture tasks throughout a meat processing facility.

The AI software running on the edge device and cloud architecture is capable of detecting a small subset of vacuum wrapped beef cuts inside a carton, reading carton outer labels and determining if there are label inconsistencies e.g. meat type in carton and meat-type name is not the same. The project did not aim to detect all possible combinations of label issues, but there is a clear path to improve the system to account for these in the future. The software system is also designed to be somewhat modular, so that different components could be re-used to solve other detection problems in a processing facility e.g. recognising meat cuts or labels further up and down the chain. The cloud dashboard was also designed to accept new camera systems or sensors which can relay vital detection information to QA staff.

Remote Inspection

During this project, the research team worked on developing new software features for a remote inspection solution such as data capture. Additionally, a significant contribution to Agri-tech cyber security was also developed. A prototype solution was developed which digitally signs live-streamed video data, making it immensely costly to fake or tamper with. In some cases, these new features were found to both improve the audit experience and for the more experimental work, demonstrated there are innovative methods that can be used to secure the authenticity and trust of audit data.

The research team also supported the demonstration and rollout of remote inspection technologies (Smart Glasses) to facilitate real remote audits, inspection and training for export certification, AAO training, equipment maintenance, and animal health surveillance. The project observed over 300 remote inspections being conducted amongst over 20 separate meat processing and audit organisations. A large portion of these led to immediate cost cuts in compliance, training and maintenance.



Figure 1: (Left) BLV rig in operation at a VIC meat processing facility, (Right) Remote inspection using smart glasses

Benefits for Industry

Benefits to the industry can be seen across many factors for each key technology researched in this project.

Continuous Verification

Traceability: The camera-based BLV system we describe here is a state of the art traceability system. It connects every box of meat packaged in a facility to two pieces of evidence, visual images of box contents and the unique label applied to the external surface.

Reallocation of QA labour: Quality assurance labour is relatively expensive due to their knowledge and experience. In contrast, box-checking is a task that could be done by a lower-paid role if supported with a computer or even potentially automated. QA workers can instead focus on reducing risk across the production process.

Reduce the likelihood of customs blacklisting: Blocking of supply following blacklisting by importing countries represents the single most significant impact on revenue for Australian meat exporters. Reducing the probability of incorrect external box labels, combined with the ability to retroactively verify box contents, represents a major step towards ensuring continued supply.

Improved import/supply chain efficiencies: Current labelling of meat is data inefficient in that there is no digital trace of individual pieces of meat. Once a box is lidded and sealed it is difficult, time-consuming and expensive to further assess the location of individual meat pieces.

Mitigation of risk: By ensuring that the label on every piece of meat accurately reflects the contents, the number, and severity of unplanned events occurring will decrease. If an incident does occur, having the clear, objective and traceable data afforded by the BLV to respond to incidents.

Remote Inspection

More productive work - Reduce the amount of time it takes to do work: By showing someone what you see in real-time, issues can be resolved in a fraction of the time it normally takes communicating via phone or email. In some instances, the time needed to travel is eliminated.

Higher Quality Output - Increased audits leading to improved quality: An organisation can dramatically increase the number of visual audits completed. This outcome can lead to a marked improvement in product quality.

Improve resource utilisation and lower labour costs: Accelerate new hire ramp-up time by mentoring employee's remotely on the job. Optimise access and use of remote experts across the company. Reduce downtime of equipment via assisted maintenance, lower cost resources to do high skill work by mentoring and supervising.

Mitigate risk: By increasing the number of audits and maintenance checks, the number and severity of unplanned events occurring will decrease.

COVID-Safe: Measures such as the adoption of SG remote inspections for compliance, maintenance and training allow companies to stay open and ensure business as usual.