
DION
BETTJEMAN
Head of Technical
Sales and Innovation
Mindhive
mindhive
LASRA®

mindhive

Model V - Leather Grading and Traceability

High Performance Neural Networks
Advanced Traceability Technologies

Mindhive

Who we are: Founded in 2011. Initially provided outsourced R&D to NZ businesses. Pivoted to focus on Neural Networks 2018/2019.
Based in Auckland with team members in NZ, Japan and the USA.

How we do it: We achieve greater profitability and reduce business risks for our clients through our specialisation in high resolution **machine vision systems** and **artificial intelligence/neural network** technology.

Where we do it: We're based in the heart of Auckland but are active globally In NZ, Asia and right across the US.

About Mindhive Industry Coverage

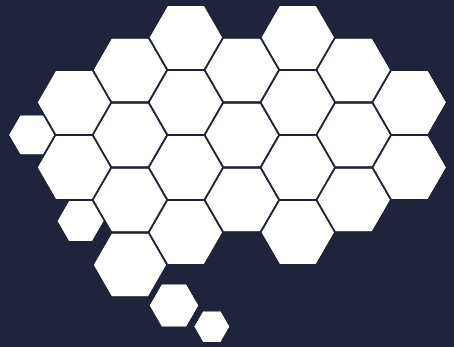
- Leather grading and inspection since 2014
- Leather traceability and data management
- Visual identification of beef cuts at packout

Neural Network (Deep Learning) Powered Leather Grading

Human Grading Know your limits

- Human based grading is highly subjective, prone to error and displays substantial levels of inconsistency over time.
- Human vision has a number of drawbacks that limit how closely an entire hide can be inspected in a short amount of time.
- Humans tend to apply rulesets with a varying degree of ‘wiggle room’. This can be advantageous at times but usually contributes to overall inaccuracy.

How do we do it??



Neural Networks (Almost) no limits

- Neural Networks are super task specific analogs of human brains.
- In most cases, they know only what we teach them - but they know it very very well.
- Neural network based defect detection offers super high levels of precision while being ‘robust’ to the various interfering factors that might be present in a tannery.
- ‘Classic’ machine vision struggles with applications outside a given tool chain. It’s great for spotting a missing bottle cap but it has no hope when it comes to determining whether a scar is open or closed.

Artificial brains Built to order

- We've gathered *massive* defect datasets (training data)

- Our neural network architecture is constantly evolving to perform better in this environment
- Each new site we bring online provides more 'regionally specific' defect examples - which are fed back into the system for the benefit of all.
- We heavily 'augment' our datasets to make them super resilient to external factors like lighting, staff movements etc.
- We can currently detect 22 different classes of defects. More are usually added with each deployment.

What can we See?

- BD - Bacterial Damage
- BR - Brand
- CS - Chrome Stain
- D - Skin Disease
- DC - Delayed Cure
- F - Flay Damage
- GR - Growth/Wrinkle
- H - Hole
- HB - Heavy Bite
- LB - Light Bite
- HE - Hair Slip/Hair
- HS - Healed Scar
- IN - Inherent
- LS - Light Spot
- M - Mole
- O - Open Defects
- OS - Open Scratch
- RW - Ring Worm
- S - Scud
- ST - Hair Stubble
- V - Vein
- W - Wart

Tannery Proof Built to survive

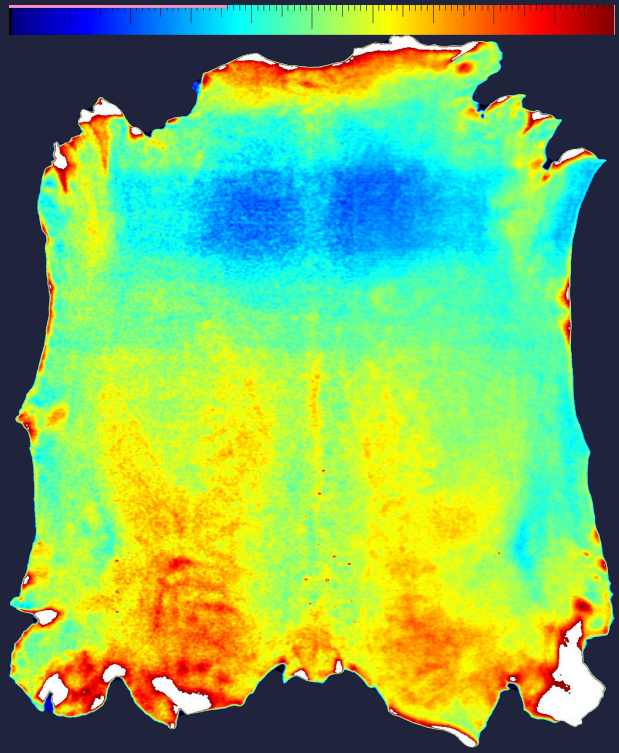
- Tanneries are super hard on ‘delicate’ equipment
- Our wet end systems are built to take a hosing, splatters, muck, grime and general tannery life.
- High availability/Hot failover processing infrastructure. Ensures grading resources are always ready when a hide presents itself.
- Redundant, isolated networks - high data volumes, ultra low latency and no ‘IT department’ red tape.
- Rugged displays, tailored integrations and local parlance.
- Purpose built light sources
- IP 67 Rated laser profilers

Four Eyes

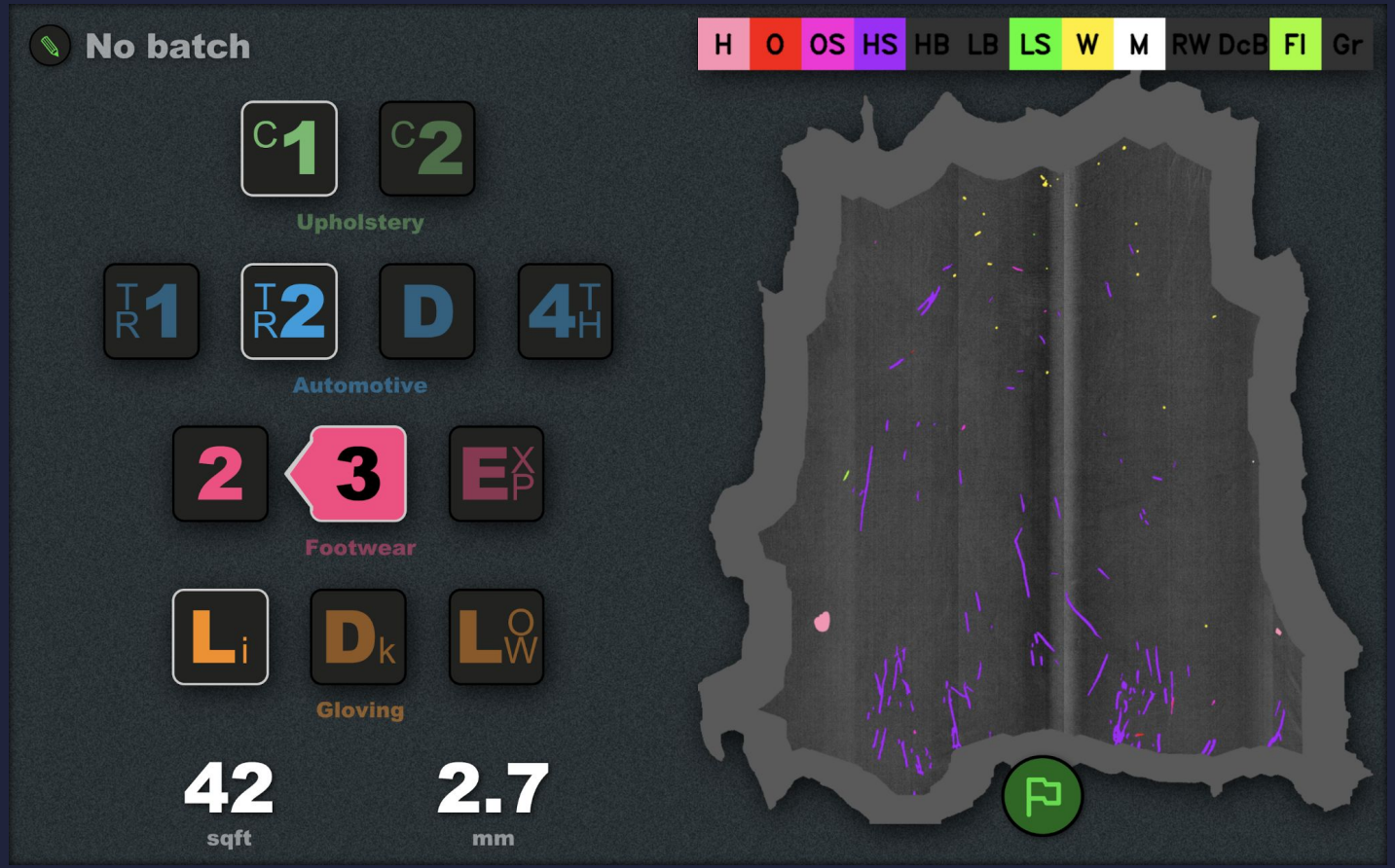
- We use 4 cameras (in most cases) To produce high resolution images of entire hides as they exit the sammer.
- We’re able to see detail down to approx .5mm across
- Processing happens in about 3 seconds
- Results are displayed before the hide reaches the stackers.

All in One

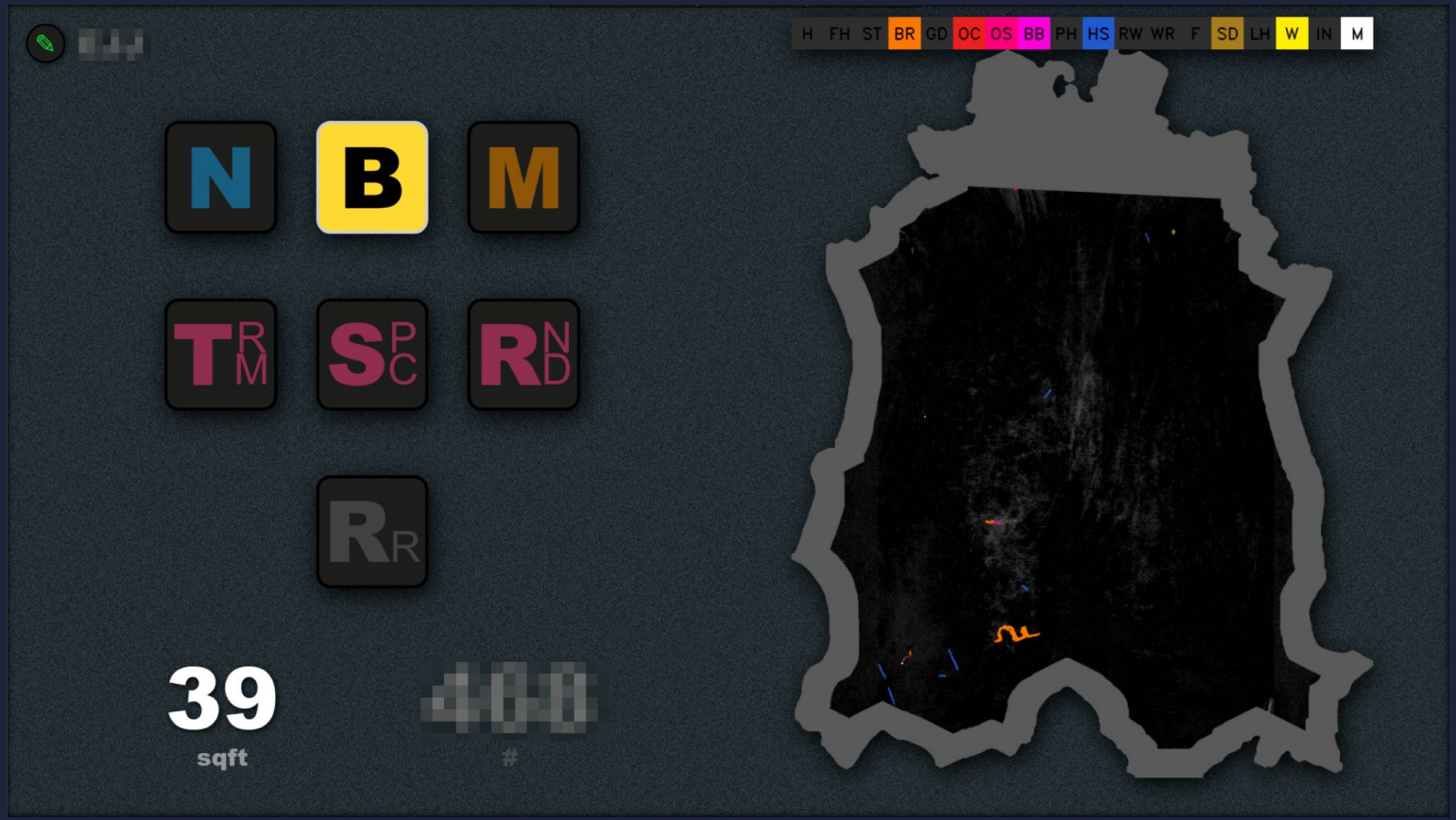
- Our graders incorporate laser profilers from Sick.
- Each hide is measured across approx 4M points at the same time as we image it.
- A thickness map is generated and incorporated into our grading decisions.
- Combined with our cameras, we produce area measurements accurate to 1 mm2.
- Eliminates other area measurement and thicknessing machines.



Information in Your language

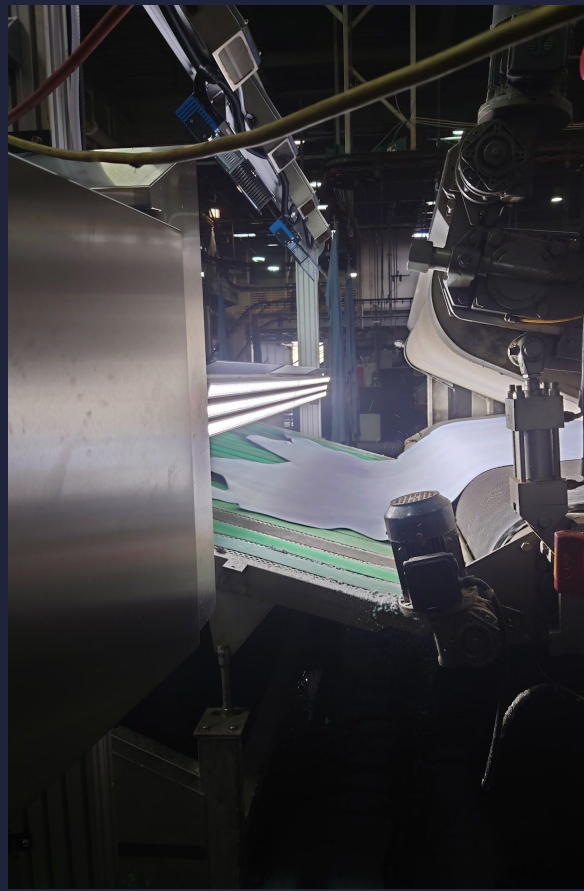


Information in Another language



Data Delivered

Small Footprint Packs a lot in



What does it Mean

- Our graders are consistent and reliable in what they detect
- Customers running ‘rules based’ grading are able to adapt their grading criteria and trust that it’s being implemented immediately and continuously
- We generate huge amounts of analytics - giving detailed insights into trends in raw materials and overall distribution of grades.
- Our machines don’t get sick, take holidays, no-show or get distracted. Every hide is inspected to the same level of detail as the one before it.
- Our systems can provide rapid feedback on production driven defects to close the loop on issues quickly.

Leathertracer
Error Tolerant, Unique IDs for *Every* Hide

Moo to You

- OEMs (and their consumers) are beginning to demand source verification for raw materials in exchange for market access.
- Existing proof of provenance paper chains are cumbersome, aimed at primary products and don’t scale easily.
- Market incumbents are too slow, labour intensive, dangerous and not very robust to tanning.
- Offshore markets loose proof of origin on the harvest floor.
- Unique IDs allow tanneries and their customers to monitor their processing on a hide my hide basis.

How not to do it

Then eventually Figure it out.....

Contraption to Completion

Tolerate Failure

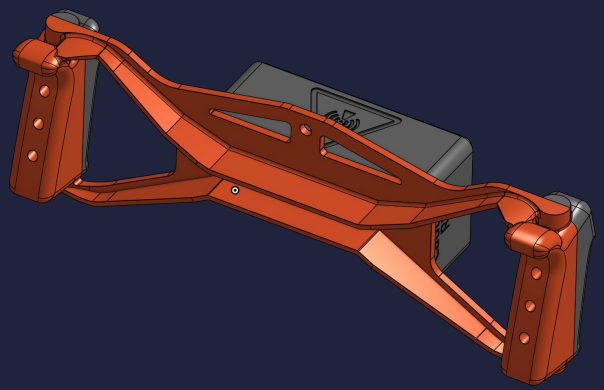
- Our final codes can be missing up to ⅓ of their characters and still be reconstructed.
- This is vital when dealing with misfires due to especially matted hair, dung or poor presentation of the hides.
- We present end users with a simple interface where they can input the characters they can make out - and we do the rest.
- Fully Automated code reading at our graders is coming next.

Immutable Record

- Our traceability data is stored in an externally verified immutable database.
- We can only add and read information - it’s tamper proof
- Data doesn’t roll over. It’s there for good.
- Hides travelling through our graders will have their grading information, defect locations, types and laser thickness maps appended to their traceability records
- 4 Billion unique, error correctable IDs currently in the pool

Excellent Now what?

- Overseas, source information for a hide tends to vanish the moment it comes off the carcass.
- We have been working on getting marking technologies onto the harvest floor for the last 2 years.
- Environmental challenges due to super aggressive cleaning processes have made robotic solutions unviable.
- We have a handheld concept in ergonomic testing at present.
- Looking to deploy first pilots into active plants Q1 2023



THANKS

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