



Automatic behavior assessment of young bulls using machine vision technology



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Manceau J., Gauthier V., Dugué C., Merle L. A., Aupiais A., Mounaix B., Boivin X., Cheype A.



A tool for automatic analysis of fattening cattle

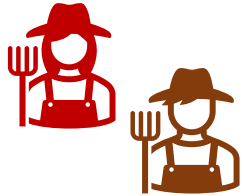


Social concern regarding animal welfare is increasing

A tool for automatic analysis of fattening cattle



Social concern regarding animal welfare is increasing

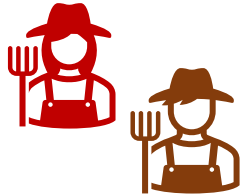


Cattle industry has adopted welfare assessment indicators and measures

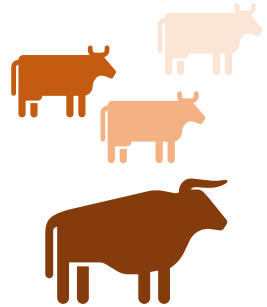
A tool for automatic analysis of fattening cattle



Social concern regarding animal welfare is increasing



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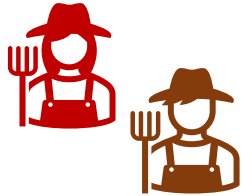
Measures of the indicators:

- ✓ Cows
- ✓ Young fattening bulls

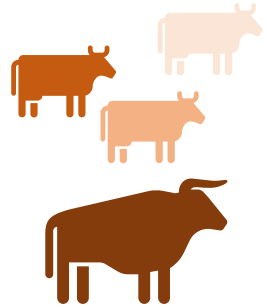
A tool for automatic analysis of fattening cattle



Social concern regarding animal welfare is increasing



Cattle industry has adopted welfare assessment indicators and measures



Measures of the indicators:

- ✓ Cows
- ✓ Young fattening bulls



Risks factors
Few behavioral indicators
Feasibility of measures

A tool for automatic analysis of fattening cattle



Projet BeBop



Behavioral data to create references



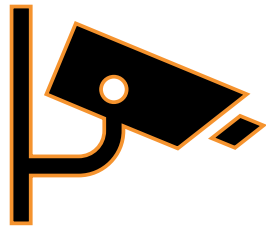
Early detection via behavior



Easy measures for welfare and health indicators



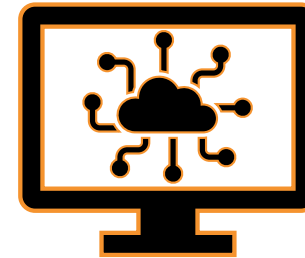
Development of automatic analysis tool for fattening cattle behavior



Database building



Video analysis



Development of artificial intelligence

Method – Video analysis



Cameras installation



4 pens with 6 Limousin
Fattening between 8 -15 months
4 cameras



8 pens with 12 Charolais
Fattening between 8 - 18 months
8 cameras



*Continuous recording during a whole fattening period
Video extraction every third day during daylight*



**Database
= 14 000 videos
= 12 To**



What behaviors do fattening bulls express ?



CATEGORIE	COMPORTEMENT	DESCRIPTION OPERATIONNELLE
REPOS	Debout-Immobilisé	L'animal se tient sur ses pattes antérieures et postérieures sans activité locomotrice. Également considéré si l'animal ne lève qu'une seule patte ou prétine, sans se déplacer.
	Couché	L'animal a son corps (sternum, flanc) en contact avec le sol et sans aucune activité locomotrice.
	Se couche	L'animal abaisse la tête vers le sol avec les genoux antérieurs pliés sous le corps ; puis basculement du corps en avant et distants de l'arrière-train à l'opposé des membres postérieurs.
	Se lève	L'animal se lève en propulsant l'écou et corps en avant (balancement) afin de soulever l'arrière-train avec les pattes arrière ; à genoux (membres antérieurs pliés et postérieurs tendus) - basculement du poids sur un genou, l'autre se dépie, et mouvement de tête vers l'arrière et le haut pour déplier l'autre genou. L'animal finit debout.
DEPLACEMENTS	Marche	Déplacement locomoteur non sauté (toujours un membre au sol) avec mouvements des pattes antérieures en opposition et postérieures également.
	Trotte	Déplacement locomoteur sauté symétrique à deux temps, avec mouvements des pattes antérieures en opposition et postérieures également.
ALIMENTATION	Ingrère	L'animal attire les aliments d'un coup de langue puis les broie et les mastique dans la bouche.
	Ramine	L'animal mastique de la nourriture sans prise alimentaire préalable.
	Boit	L'animal présente le mufler dans l'abreuvoir en conservant les narines hors de l'eau et aspire l'eau.
SOCIAUX AGONISTIQUES	Menace	L'animal a la tête baissée, front/cornes en avant orienté vers le congénère ; abaissement du chanfrein ou même mouvement que "coup" mais sans contact, l'animal menacé s'écarte/fuit.
	Coup	Contact avec vitesse de la tête (chanfrein) ou des cornes sur une partie du corps de l'autre animal.
	Lutte	Les animaux sont debout, en interaction tête contre tête avec un engagement du corps (poussée) en opposition des deux animaux.
	Évitement/Fuite	L'animal tourne la tête ou s'en va quand un autre approche.

Extensive ethogram
with 44 activities et 15 postures



Technical publication
available on idele.fr

Results – Database building



Can all behaviors be spotted on video ?



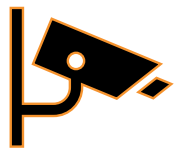
Results – Database building



Can all behaviors be spotted on video ?



Frequent activities and postures



Direct video analysis

Example : lying animal



Direct observation



On camera



Can all behaviors be spotted on video ?



Brief or rare activities and postures



Direct observation



Can all behaviors be spotted on video ?



Brief or rare activities and postures



Direct observation



Example : tongue rolling



Direct observation

Can all behaviors be spotted on video ?



Brief or rare activities and postures



Direct observation



Video observation of previously spotted behavior



Example : tongue rolling



Direct observation

Results – Database building



Can all behaviors be spotted on video ?



Brief or rare activities and postures



Direct observation



Video observation of previously spotted behavior



Example : tongue rolling



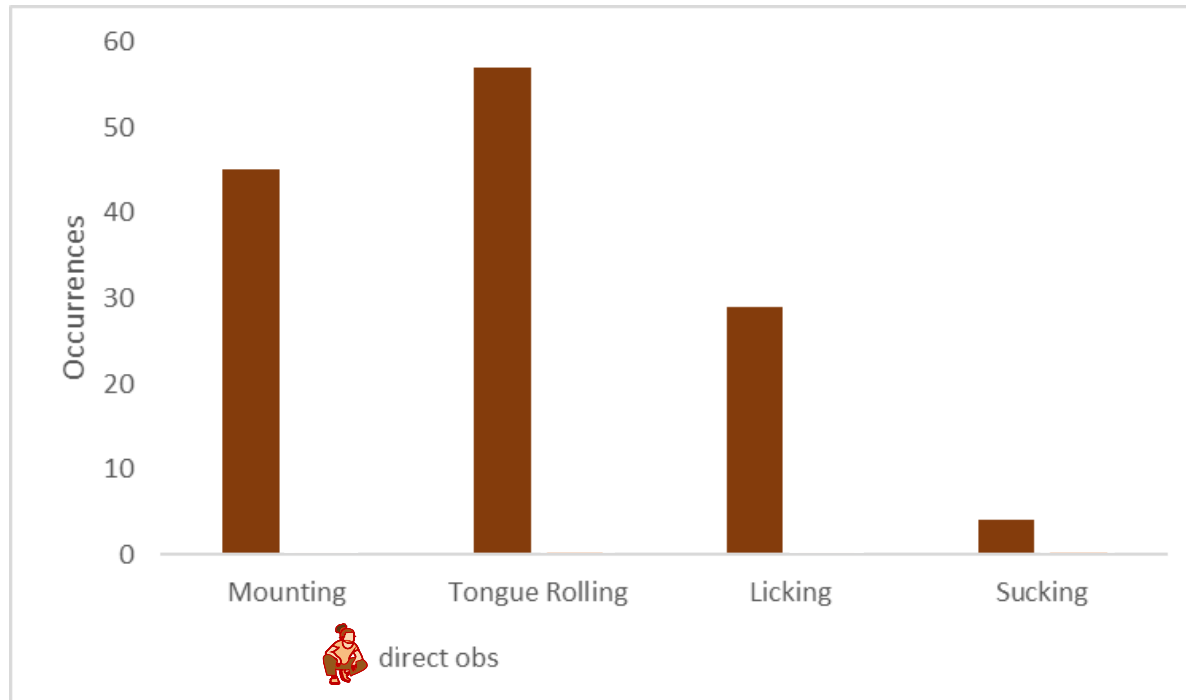
Direct observation



On camera

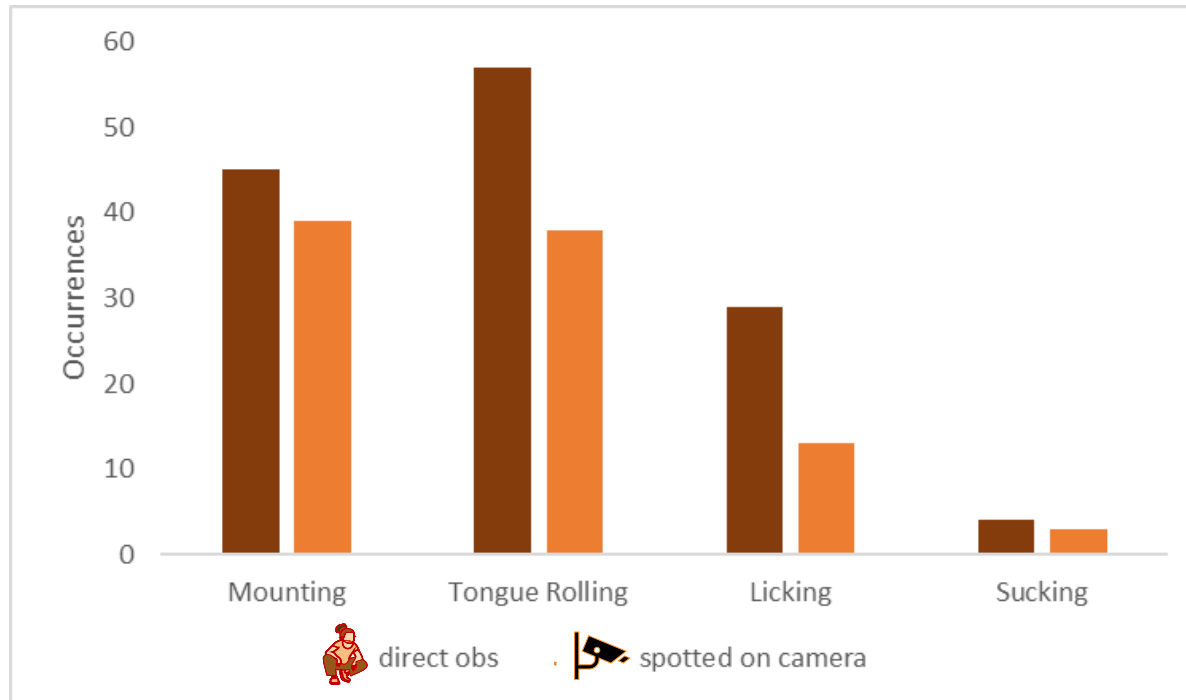


Can all behaviors be spotted on video ?





Can all behaviors be spotted on video ?

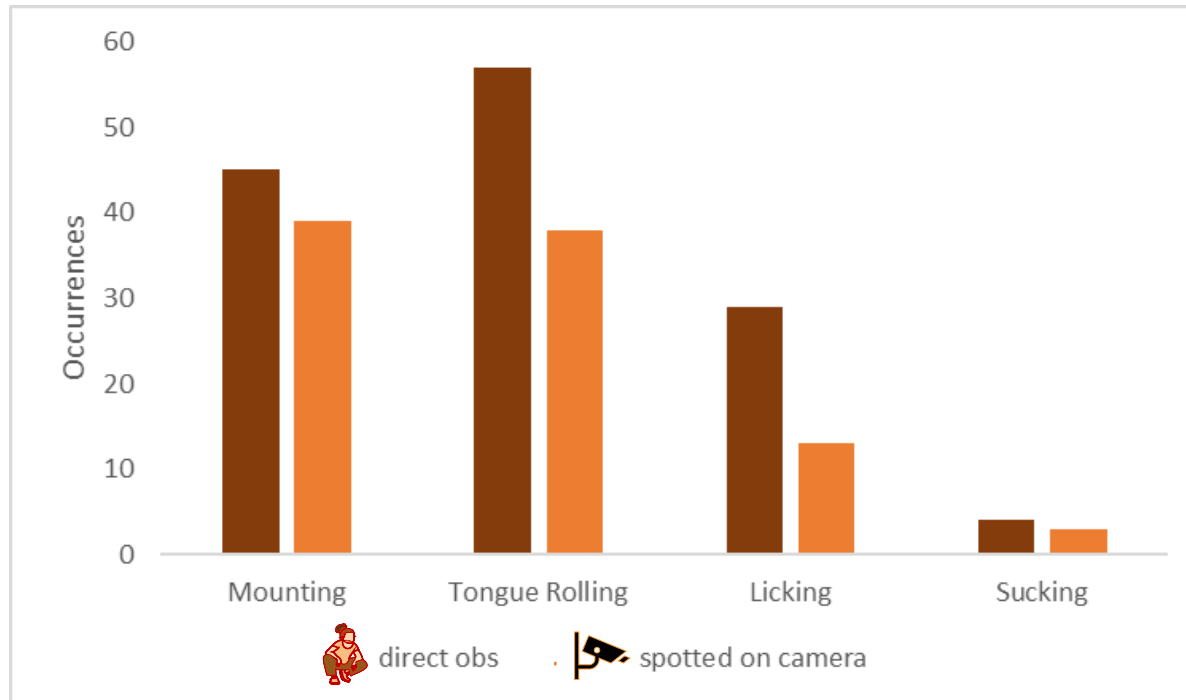


45 – 87% of rare or brief behaviors could be spotted on camera

Results – Database building



Can all behaviors be spotted on video ?



Extensive ethogram with 44 activities et 15 postures



Reduced ethogram with 19 activities et 3 postures

45 – 87% of rare or brief behaviors could be spotted on camera

Method – Video analysis



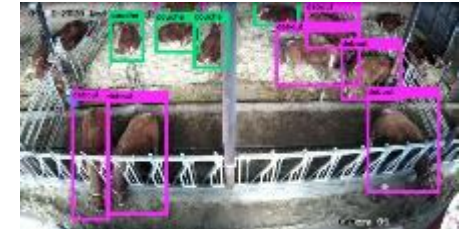
Easy video annotation



TaTToo
Video software analysis used for annotation



Localisation



Postures



Activities



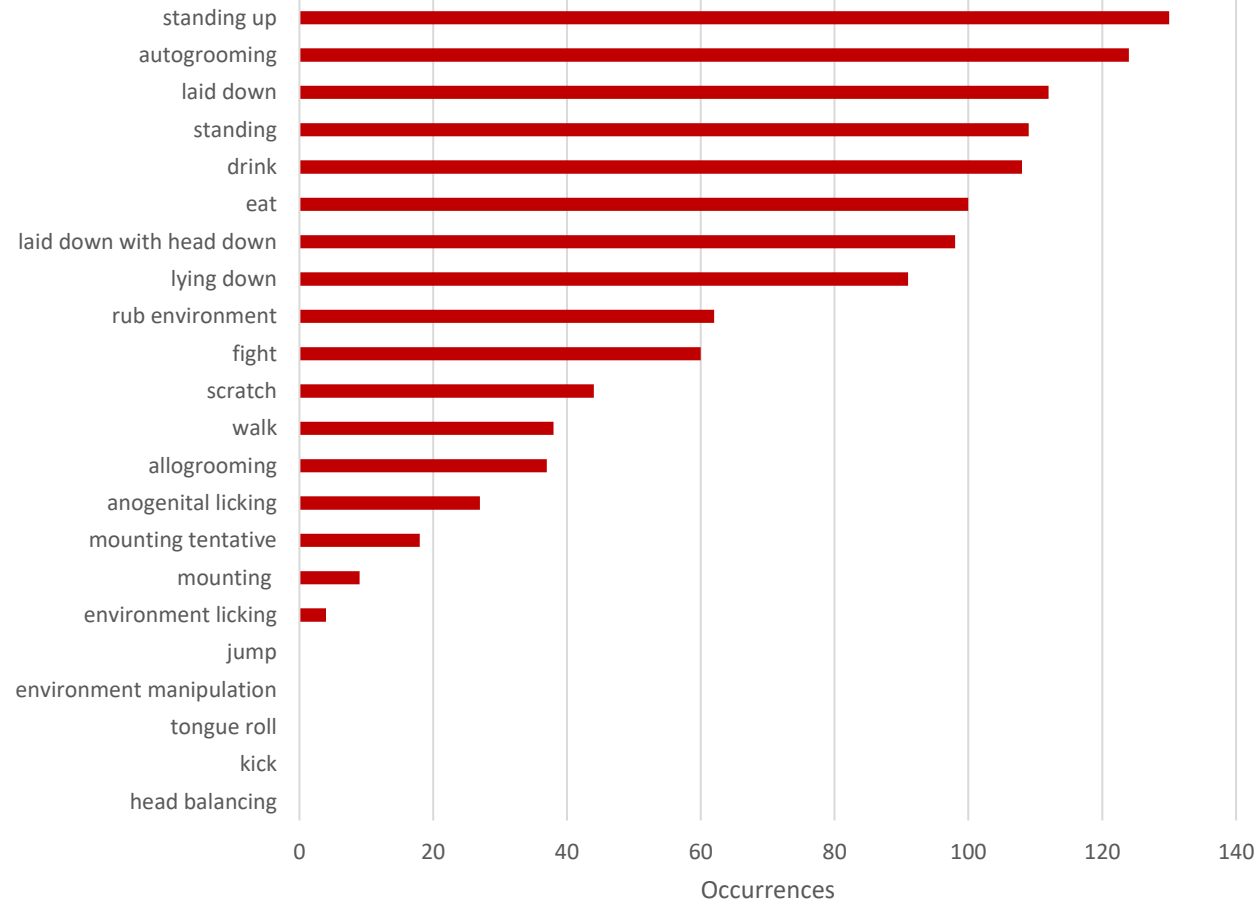
drink

eat

Results – Video analysis



Since April...



Method – Artificial intelligence development

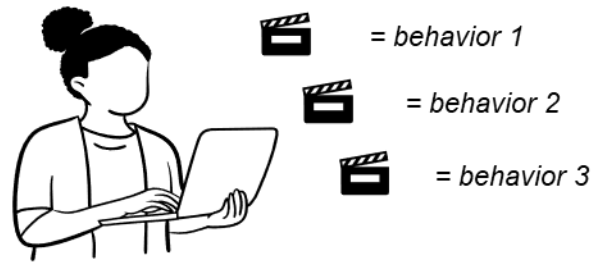


Artificial intelligence via deep learning





Artificial intelligence via deep learning



Learning Phase

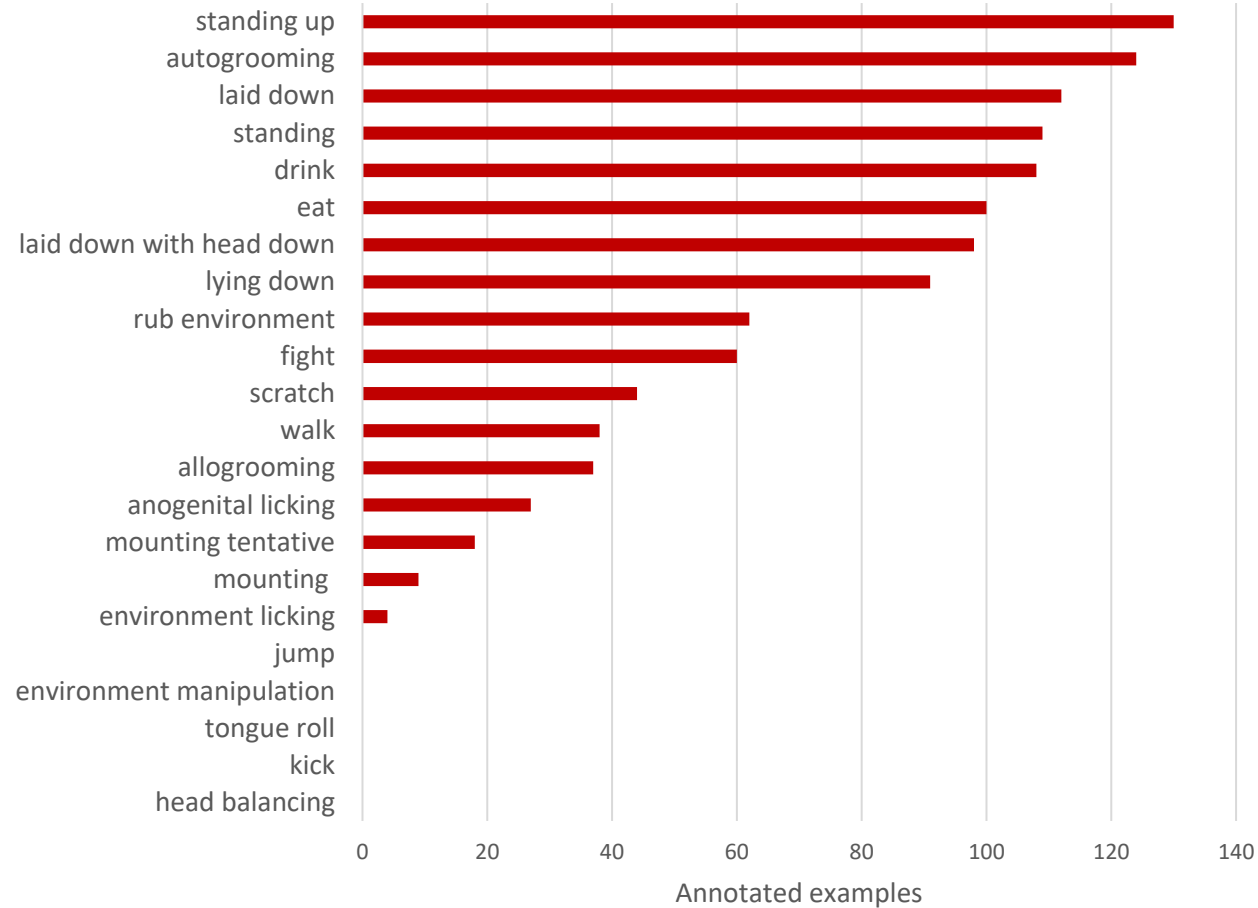
The expert identifies behaviors and position of bulls in their pen

Objective : *annotate 750 examples per activities and postures*

Results – Video analysis

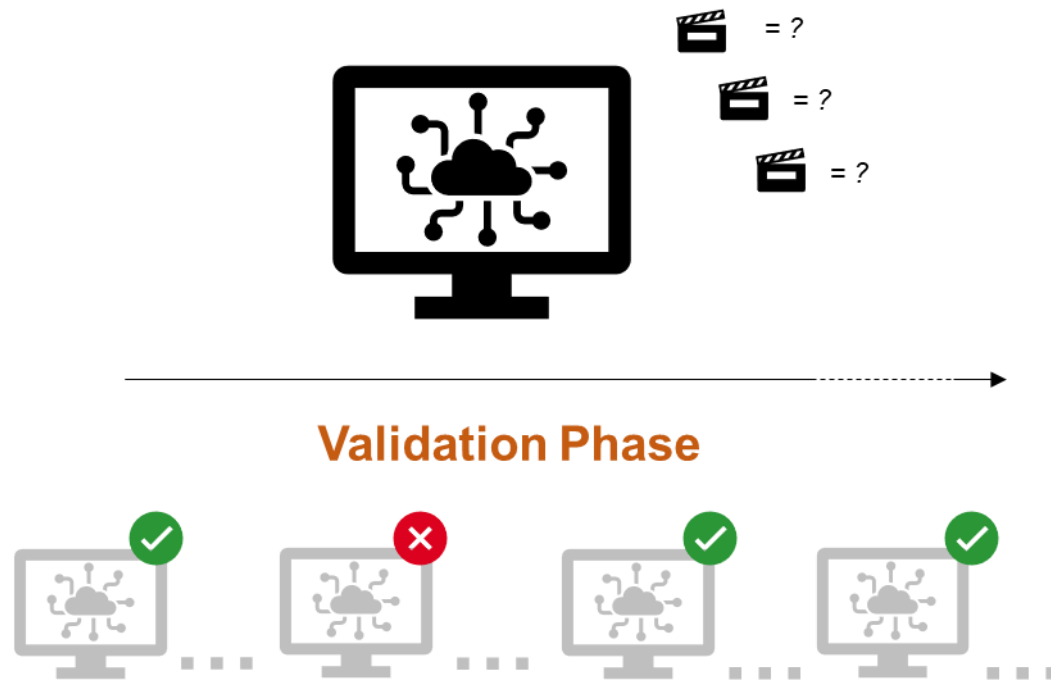


Since April...





Artificial intelligence via deep learning

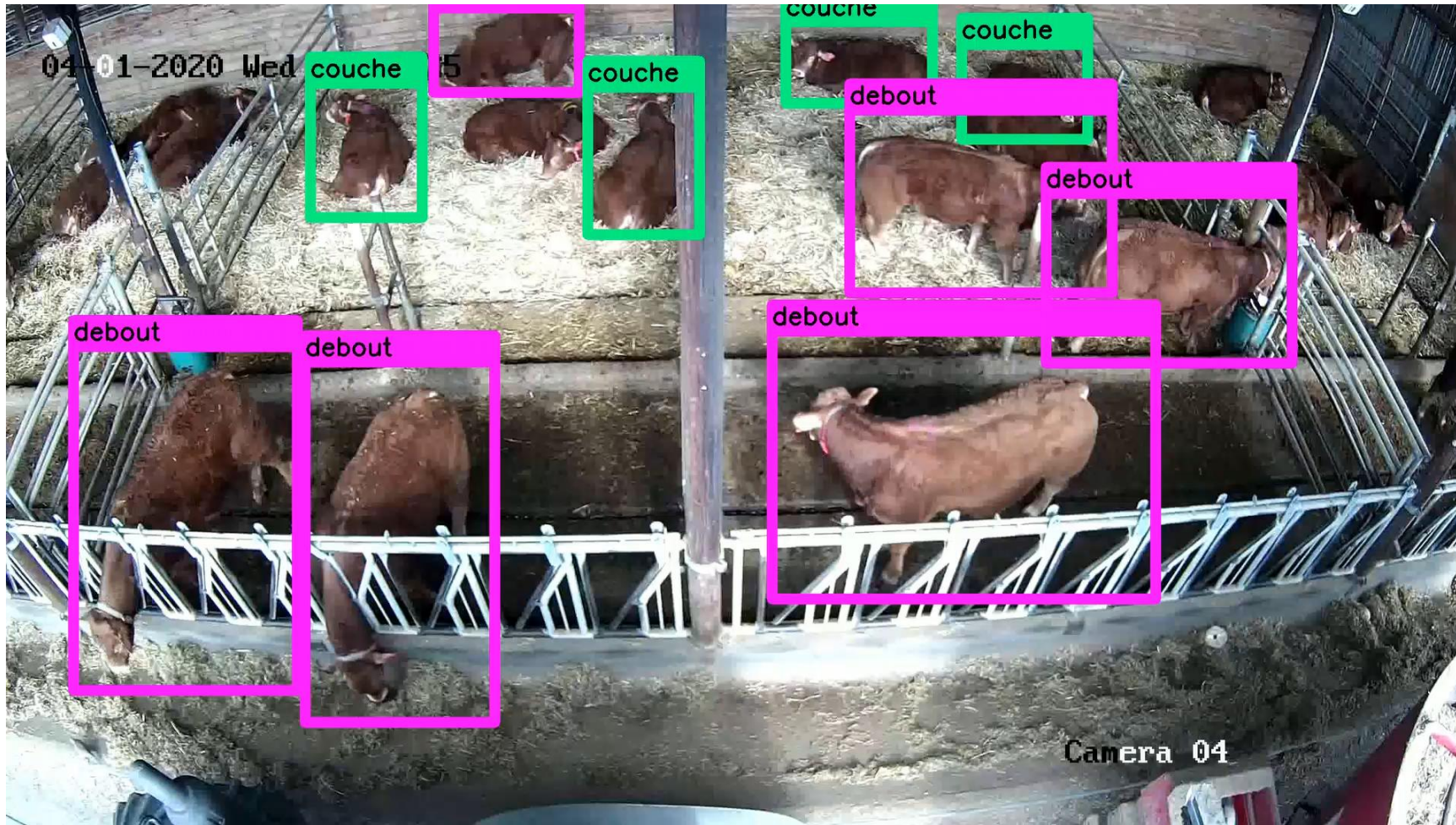


The algorithm analyses non annotated videos and predict behaviors

Objective : predict 250 examples per activities and postures

Results : precision & sensibility

Results – Artificial intelligence development



Promising solution to...



Create references for simplified welfare assessment

- Describe the behavioral range of young fattening bulls
- Quantify their frequency and localisation of activities and postures



Detect early welfare variations via behavior

- Notice specific behaviors (agonistic interaction, stereotypies...)
- Estimate various indexes (repartition, proximity, movements...)

Thank you for your attention



INRAE NeoTec-Vision

