Use of big data in animal production and animal breeding

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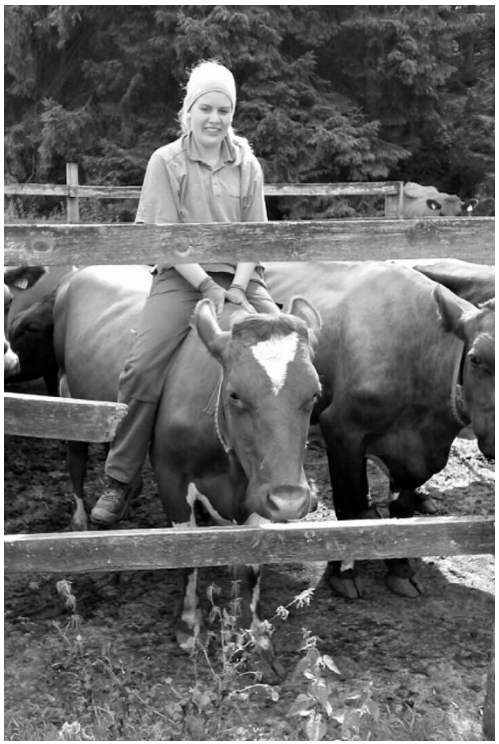
Keynote speaker: «big data from forest machines»

My background



- Ph.D student at Norwegian University of Life Sciences (NMBU)
- Animal breeding and genetics
- Part of the AMS–project :

New approaches for management and breeding of dairy cows in automatic milking systems

Short introduction to animal breeding

- **Purpose of breeding program**: improve desirable traits → genetic gain

- For ex: more milk, better health, stronger legs, more meat

- Traits needs to be **heritable** + **genetic variation** between individuals must exist.

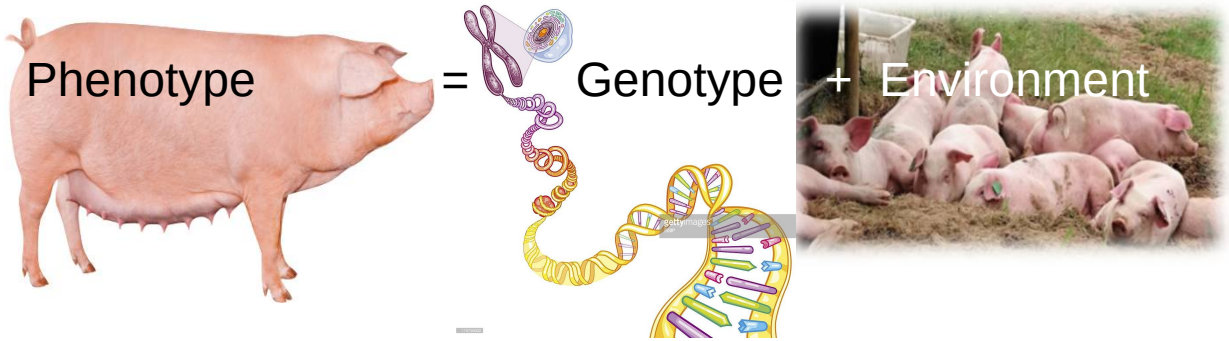
- **How to improve traits?**

Need phenotypic and pedigree information to select the best animals

Short introduction to animal breeding

Two main sources of data on animals

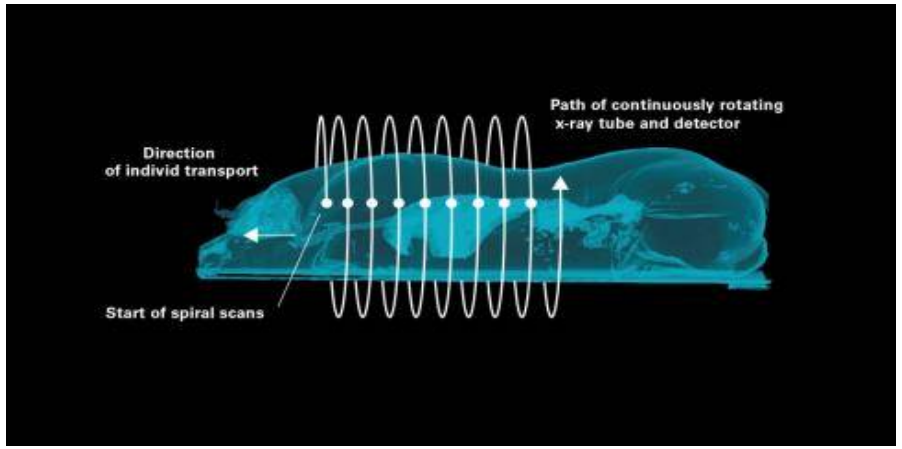
1. Phenotype

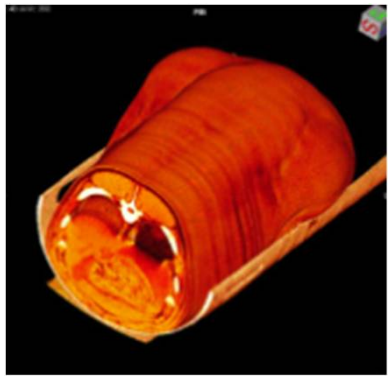


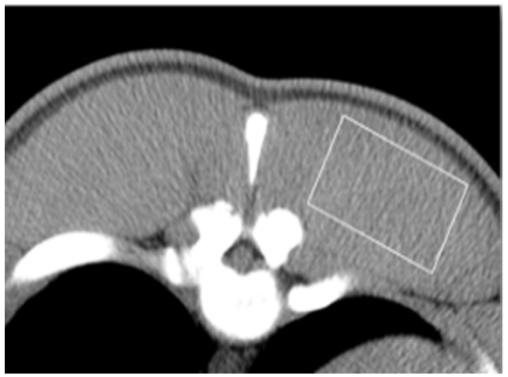
2. Genotype

Use of big data in pig breeding

CT scan of more than 25 000 boars since 2008







Feeding stations with weight:

Norsvin

Use of big data in pig breeding: Genotyping

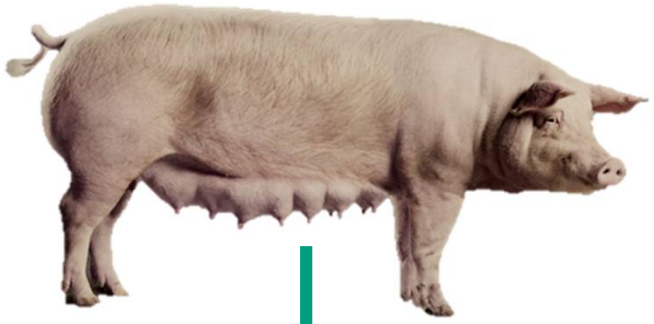
- Fast emerging field/big data in animal breeding
- Genotyping: Information about an individuals DNA/genes
- Genomic relationship: more accurate relationship between animals

Norsvin

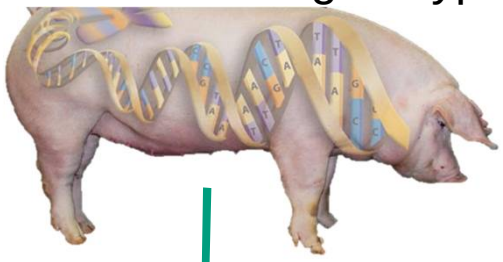
Use of big data in pig breeding: Genomic Information

- Genotyping started in 2012

Norsvin Landrace



42 000 individuals genotyped



60 000 known “positions” on the DNA for one animal

Dairy cattle breeding

- Geno: breeding company
- Norwegian Red dairy cattle (NR)
- Breeding for economic important traits:
  data on health and fertility since 1970
- Health and fertility – less controlled by genes,

→ data quality essential

Use of big data in dairy cattle breeding

- Potential breeding candidates genotyped as calf
- Number of genotyped NR individuals = 40 000 :

  (50 000 DNA-positions/sites for each animal)

- 2012 : Geno started to use genomic data for selection of breeding bulls
- Combine phenotypic and genomic data→ faster genetic improvement

Big data from genotyping:

- In all livestock species:

↑ No of genotyped animals

↑ Information about DNA positions (more details of DNA)

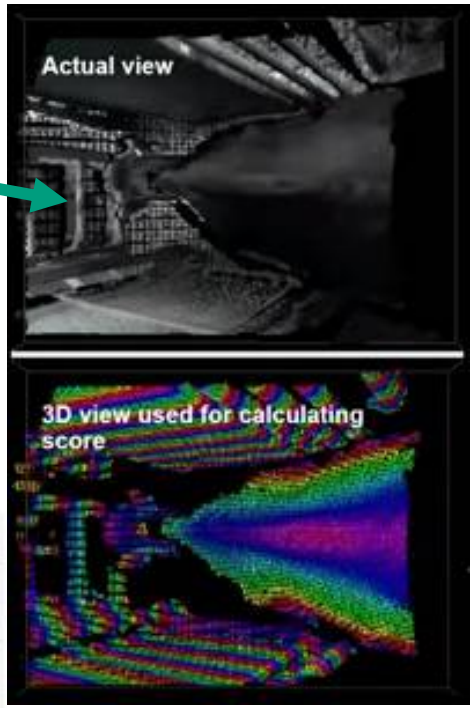
Low density → high density → sequence data

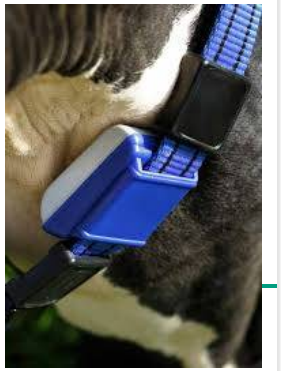
→ Genotyping of animals at birth will be routine

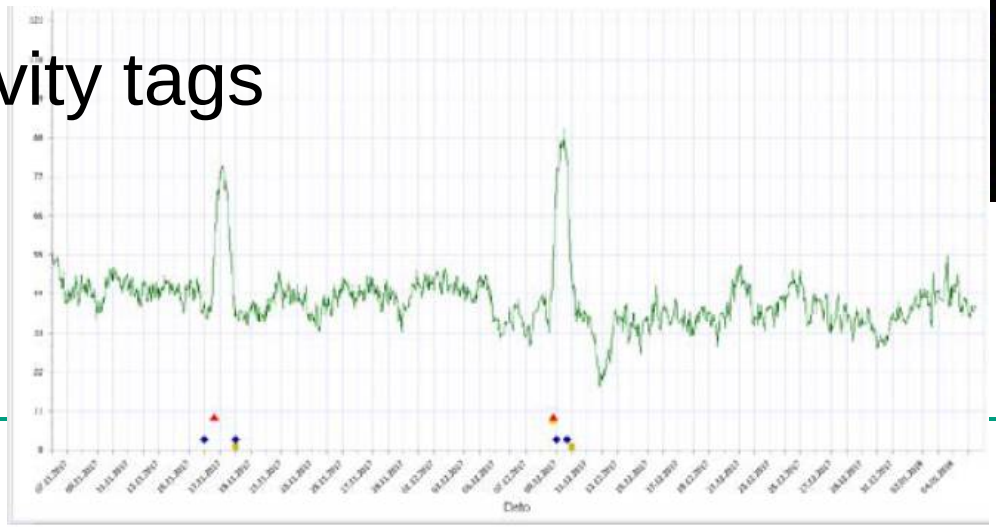
Sensor Technology and big data in Dairy Production

Different types of sensors:

- 3D camera for body condition
- Feeding stations and scale
- Sensor measuring rumination
- Activity tags







Sensor technology in Dairy production - AMS

- **AMS** = automatic milking system
- > **1800** AMS in Norway
- More than **42 % of the milk** from cows in AMS
- Reasons for popularity: **herd size and high labor** costs
- Cows **voluntary** milked: 65 cows per day

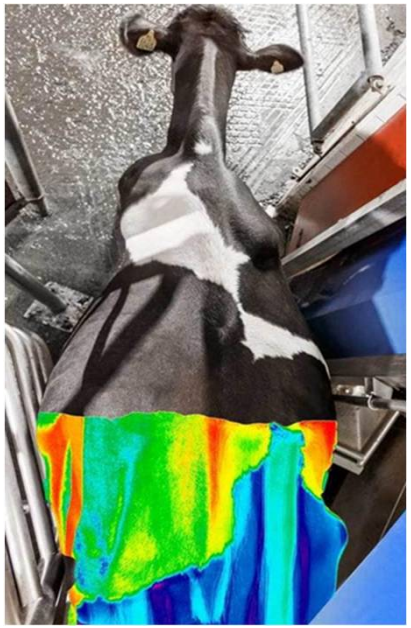
Associated sensors in AMS

Sensors connected to AMS, in-line measurements milk:

- **Online somatic cell count** (OCC)

- Milk samples with information on feeding status and fertility.

- **Progesteron** hormone → pregnancy
- **ß-Hydroxybutyrate** (BHB) in milk → ketosis



Future:

- Measure **methane** from each cow
- **FTIR** (infrared spectroscopy): milk composition

AMS project - genetic analysis of data from AMS

- Data from **77 Norwegian AMS** farms

→ Genetic analysis of cows milkability and behavior

- More than **5 million records/visit** from **5 000 cows.**
- *Milk yield (kg), milking speed (kg/min), occupation time (min), number of milkings, kick offs.*

Results:

- These records are explaining cows milkability and behavior in AMS → genetic component→ heritable
- AMS-data = objective and continuous

Big data in dairy cattle breeding

Status:

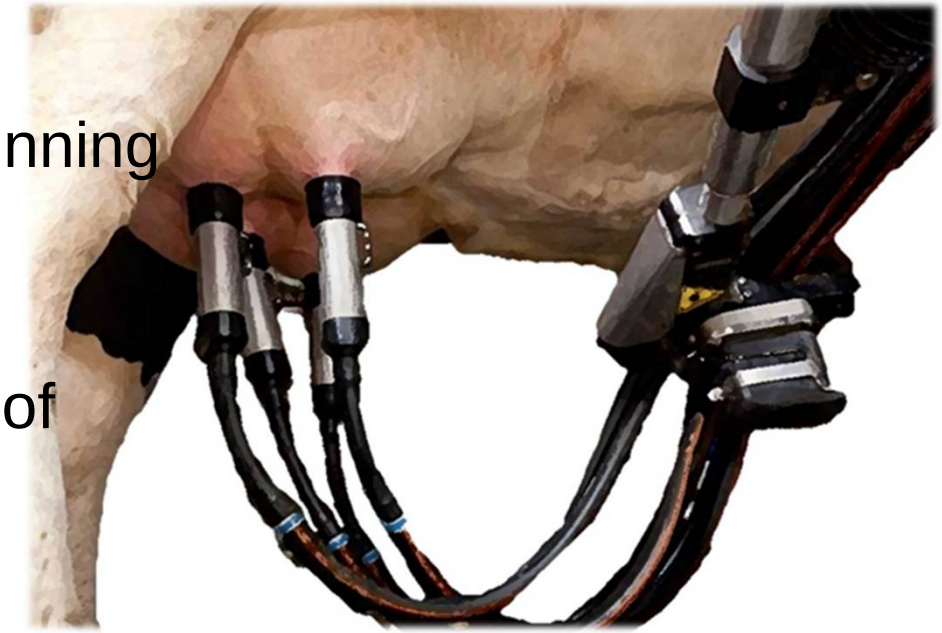
- Still a way to go:

- Data from AMS and other sensors → not yet available in the genetic evaluation
- Loose data every day

- Need of a system for automatically uploading this data
- Important to start using AMS data in breeding!

Future potential – real time data in herd management

- Future potential in use of real time data from different sensors to **predict disease** of a cow
- **Often little signs** in the beginning before production drops
- Combine **different sources** of information into algorithms



Conclusion

- Big data used today in animal breeding
- Sensor data useful for breeding → objective and repeated measurements
- Future breeding program will include more and more information from big data

Thank you for your attention!