Across-breed imputation with whole genome sequence data in dairy cattle

Background

Genome-wide association studies require large sample sizes. Because only a few ancestors account for most of the diversity in dairy cattle populations, sequence information from key ancestors can be used to impute sequence variants on relatives with array-based genotypes, providing a cost-effective alternative to sequencing all animals. Here we use BTA25 to assess imputation accuracy using different reference scenarios. Sequence information of 50 Brown Swiss animals was masked to mimic that of medium and high density SNP-chips. The full sequence was then imputed, and the percentage of correctly imputed loci was assessed. The diversity in dairy cattle populations, sequence variants on relatives with array-based information of 50 Brown Swiss animals was masked to mimic that of medium and high density SNP-chips. The full sequence was then imputed, and the percentage of correctly imputed loci was assessed. The correlation between true and imputed genotypes was also calculated.

Sequence Data:

Data from two independent next-generation sequencing projects were merged to create a final data set with 1233 animals:
- 1147 animals (1000 Bull genomes project, Run 4: multi-sample variant identification Samtools, Li et al, 2009)
- 86 animals (Gene2Farm project: single sample variant identification (Freebayes, Garrick and Martin, 2012))

The merged data set was analysed using principal component analysis (GCTA, Yang et al., 2011).

Four reference scenarios were set up according to first and second principal component values:
- Scenario 1: 395 animals most similar to Swiss Brown Swiss
- Scenario 2: 395 animals slightly less similar to Swiss Brown Swiss
- Scenario 3: 393 animals most dissimilar to Swiss Brown Swiss
- Scenario 4: 1183 animals (entire data set)

References:


Bauer C,2, Seufried F,2, Bagot R3, Flury C1, Signer-Hasler H1, Garrick D1, Stricker C1, Greilicher B2

1 Bern University of Applied Sciences, Switzerland
2 Qualigenetics, Switzerland
3 Iowa State University, United States of America.
4 agro Genetics, Switzerland