

Chip-size, Low Cost NIR Sensors for Milk Analysis With Lab Grade Performance



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neospectra
SI-WARE
SYSTEMS

Milk & Dairy Market

\$1,000,000,000,000

Estimated milk & dairy market size by 2024



Market Needs

Ensuring Milk Quality From Cow to Cup



Market Needs

Key Features of Ubiquitous Milk Analysis Solution



Accurate

Instant

Cost-Effective



Conventional Methods



 wet chemistry



 ultrasonic



 infrared

Accurate



Instant

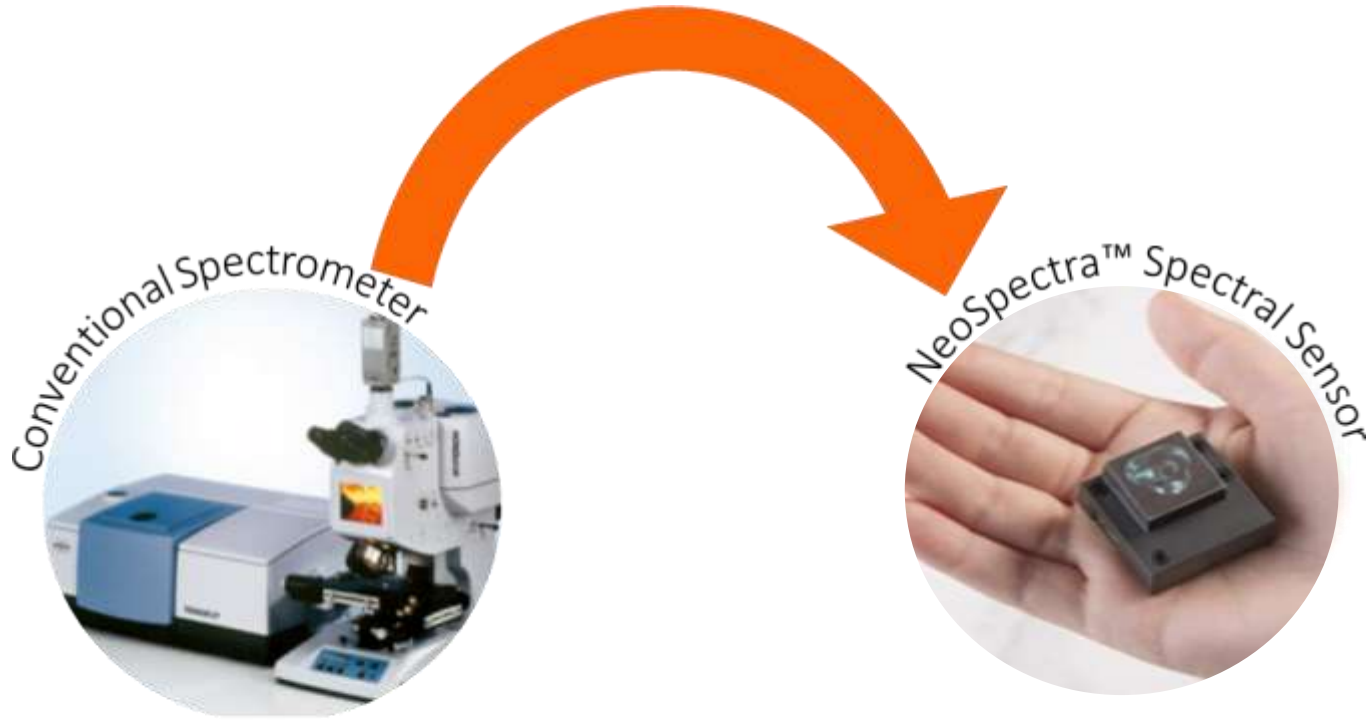


Cost-Effective



NeoSpectra

Bringing spectroscopy from the **lab** to the **farm**

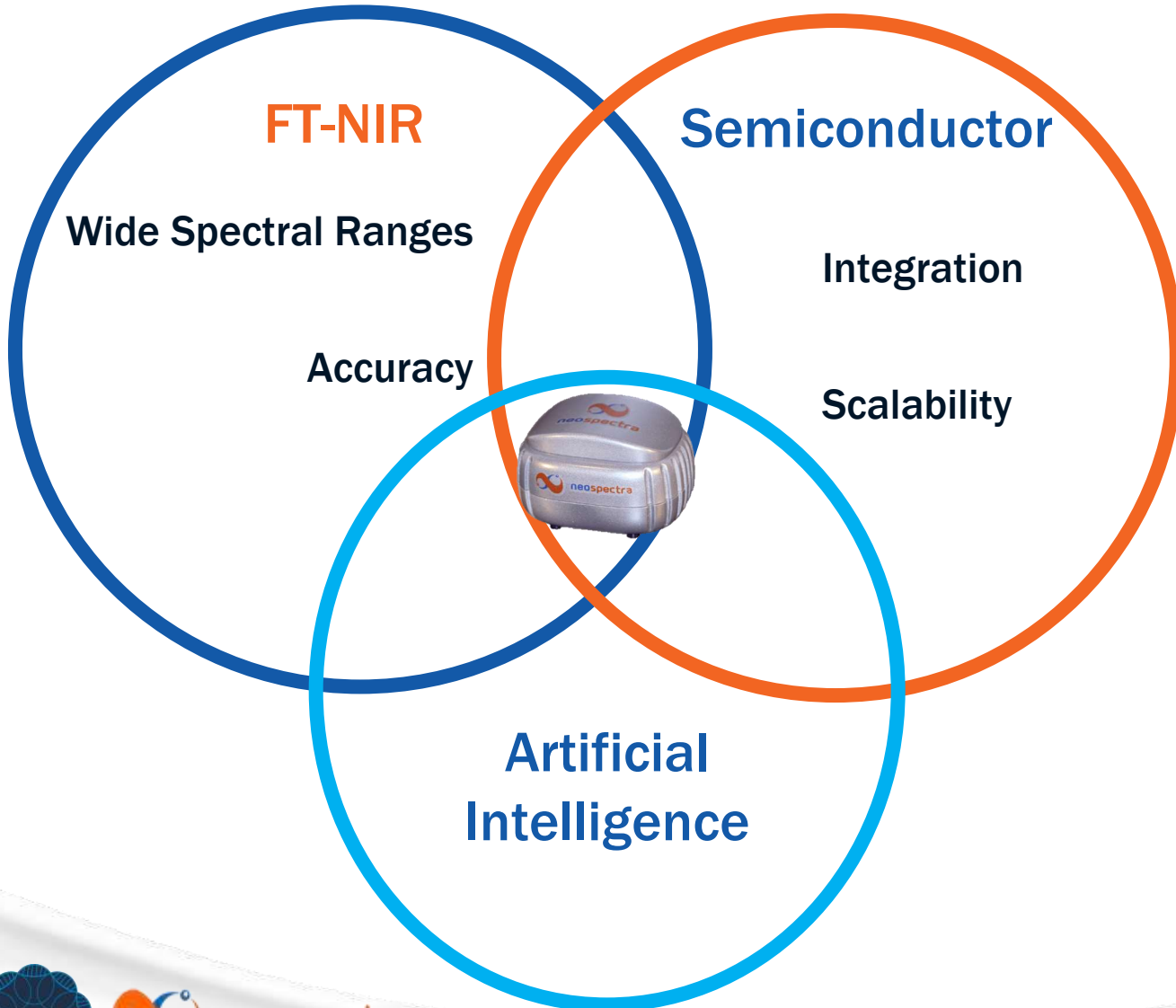


LAB Analysis

Analyze anywhere



NeoSpectra Solution



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NeoSpectra Solution

1st Portable FT – NIR
Compliant with ICAR Standards



Accurate

Instant

Cost-Effective



Impact on supply chain



Herd Health & Productivity

Regulations & Policies



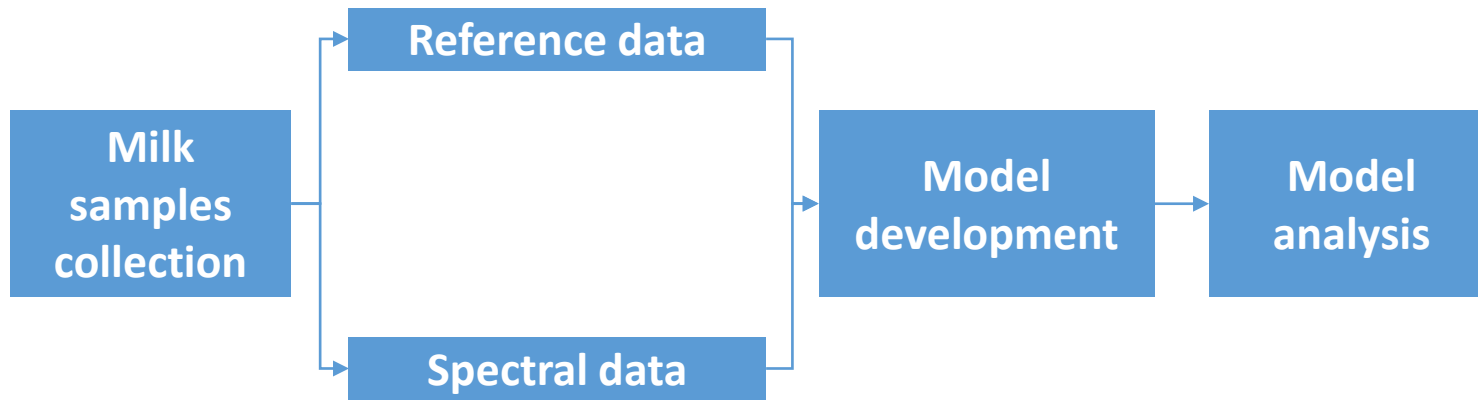
Milk Quality & Pricing



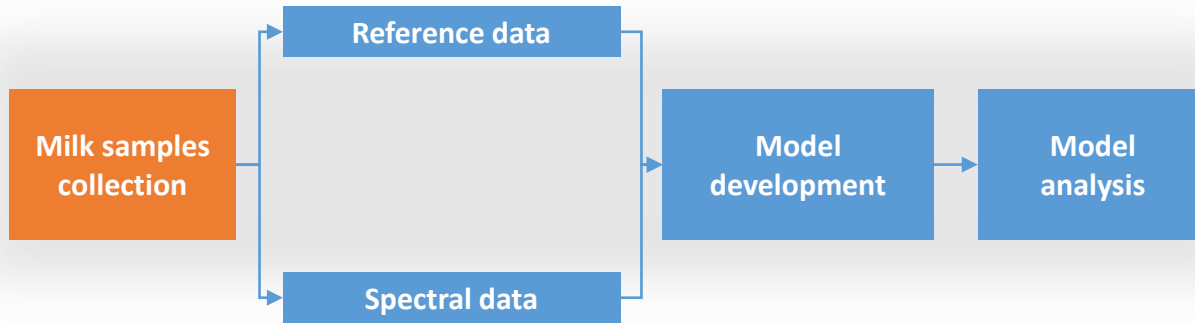
Quality & Process management



Building prediction models



Milk samples collection



2

Cow Types

4

Farms

2

States

110

Cows

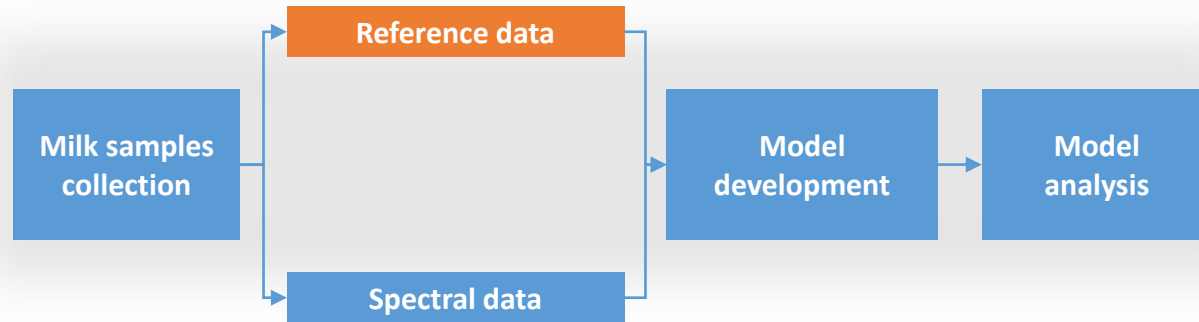


110

Milk Samples



Reference measurements



Standard reference methods

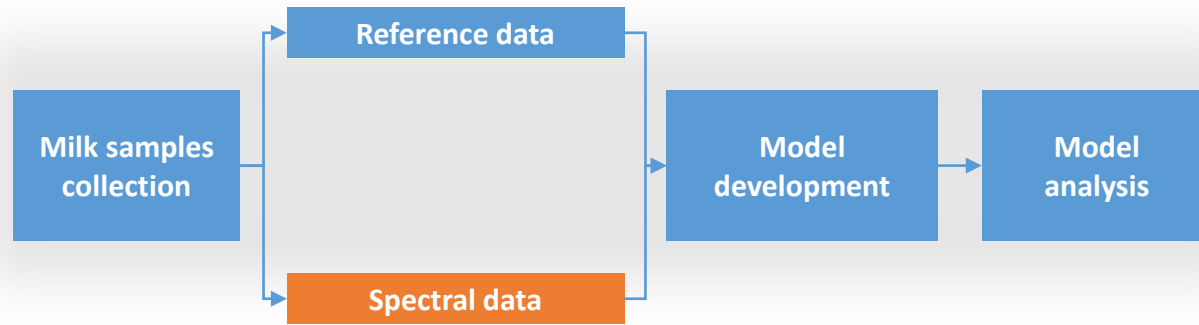
Protein content → Kjeldahl method

Fat content → Gerber method

Lactose content → Fehling test



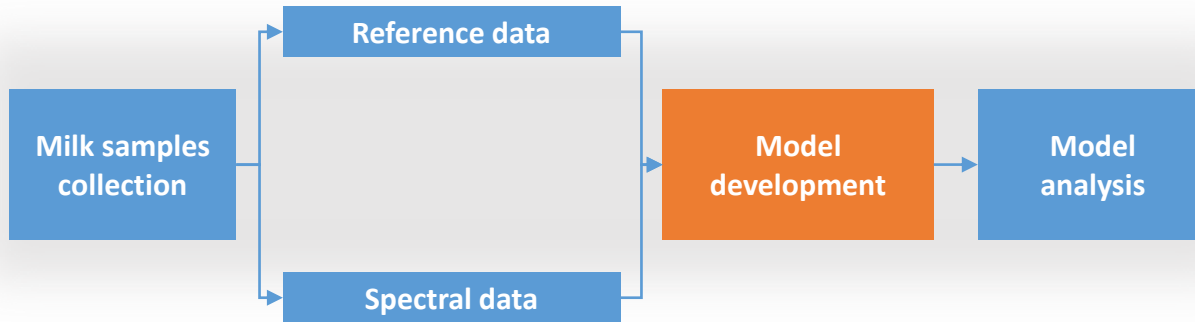
Spectra measurements



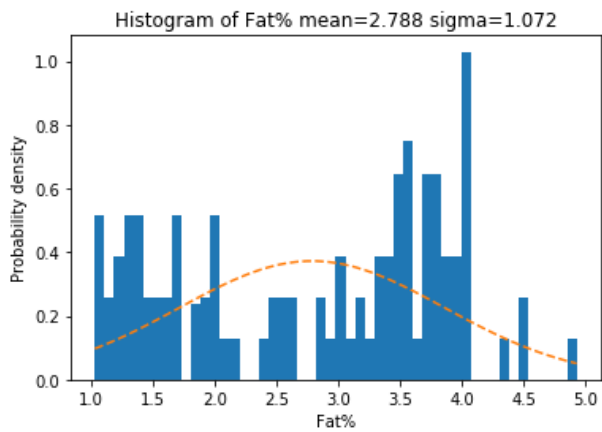
Simple Setup

Easy to replicate in-field

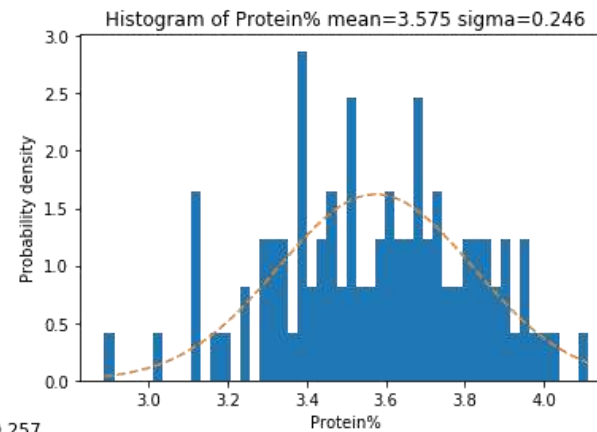
Data distribution



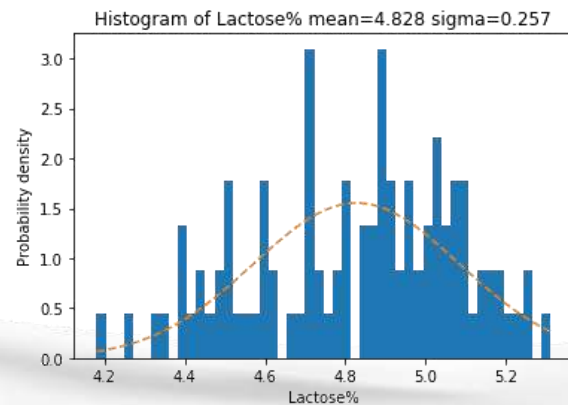
Fat



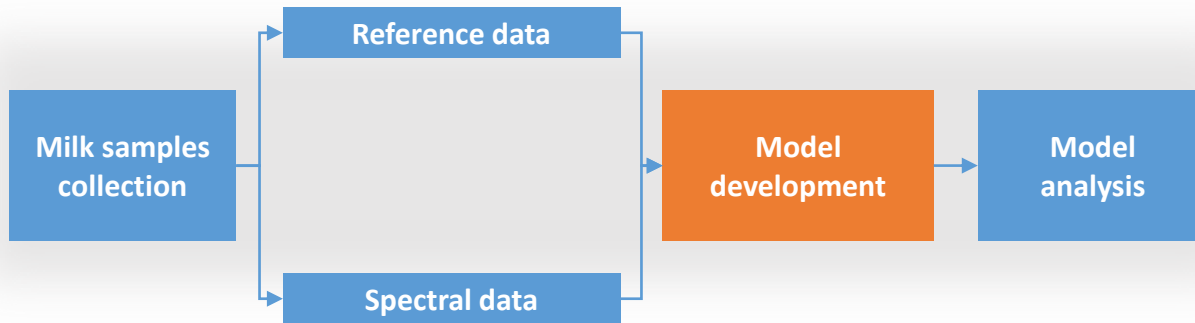
Protein



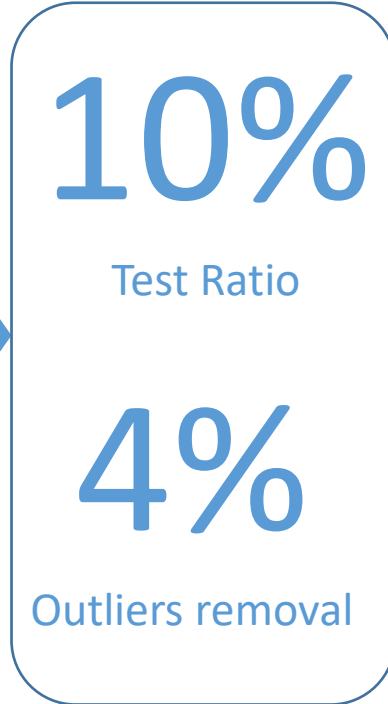
Lactose



Model development



110
Milk Samples



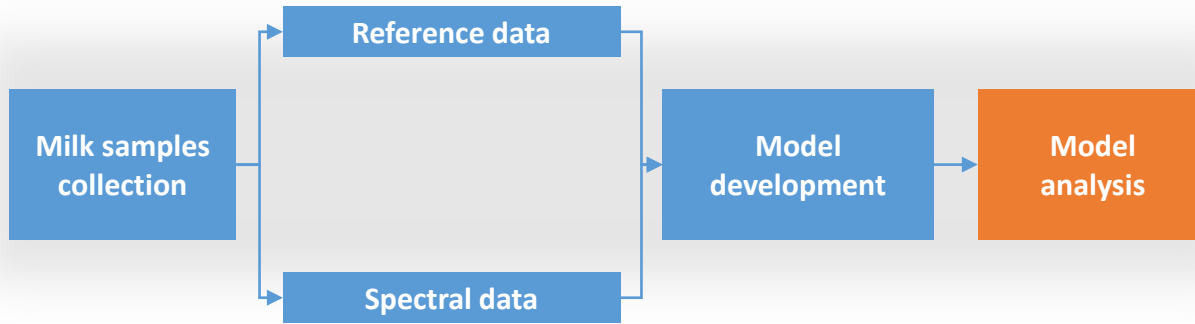
Linear method

→ PLS

Non-linear method

→ Neural Networks

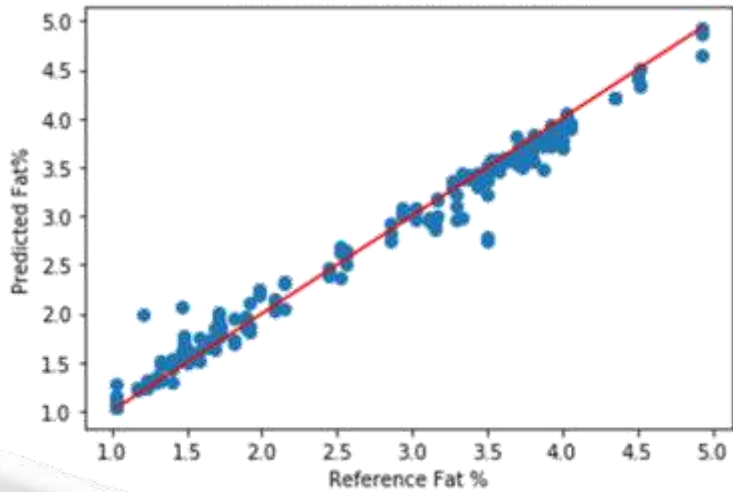
Model results



Fat prediction

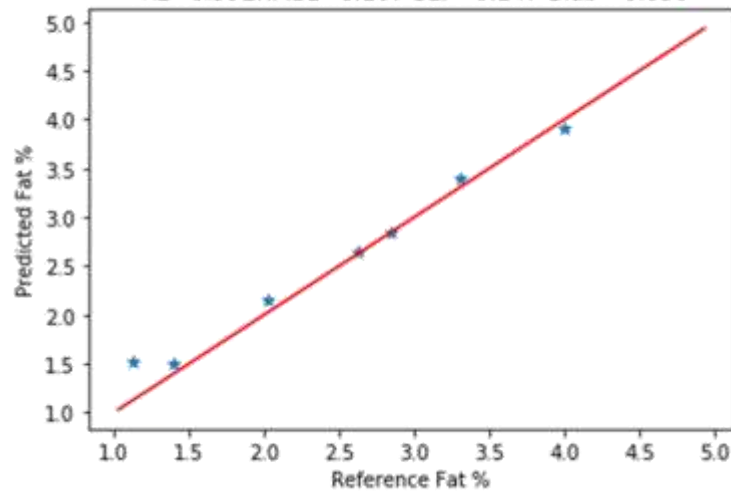
Calibration

$R^2=0.984$ RMSE=0.158 LV=48

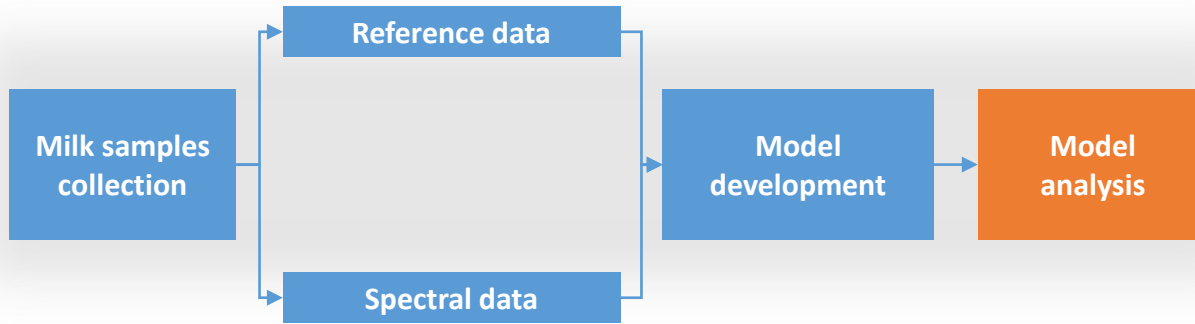


Test

$R^2=0.991$ RMSE=0.167 SEP=0.147 Bias= 0.096



Model results



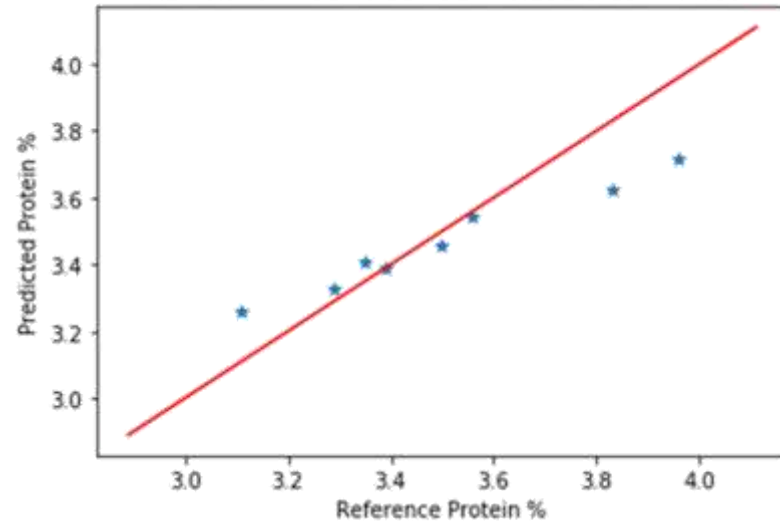
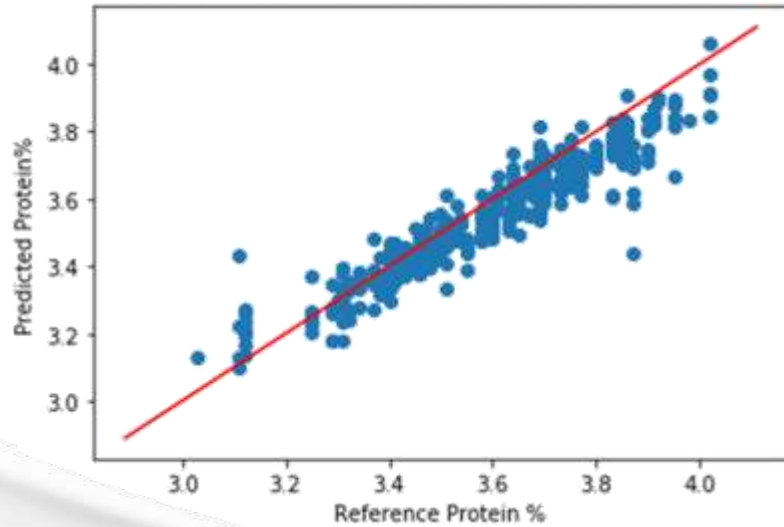
Protein prediction

Calibration

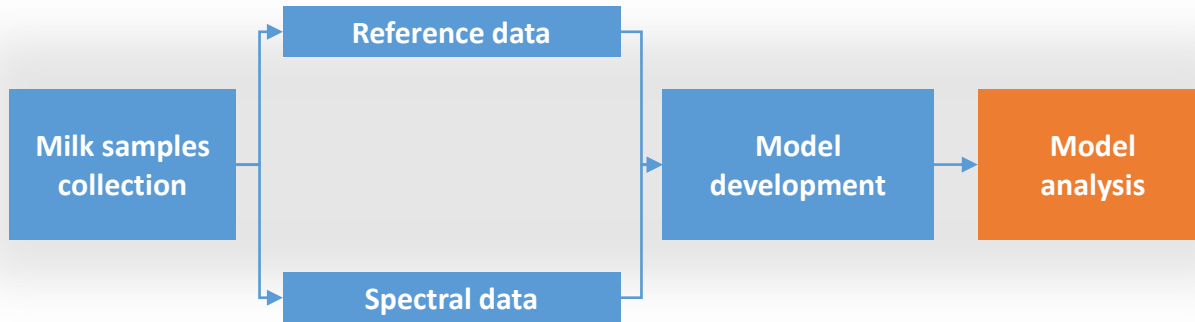
Test

$R^2=0.891$ $RMSE=0.078$ $LV=50$ $SEP=0.068$ $Bias=-0.039$

$R^2=0.979$ $RMSE=0.127$ $SEP=0.131$ $Bias=-0.033$



Model results



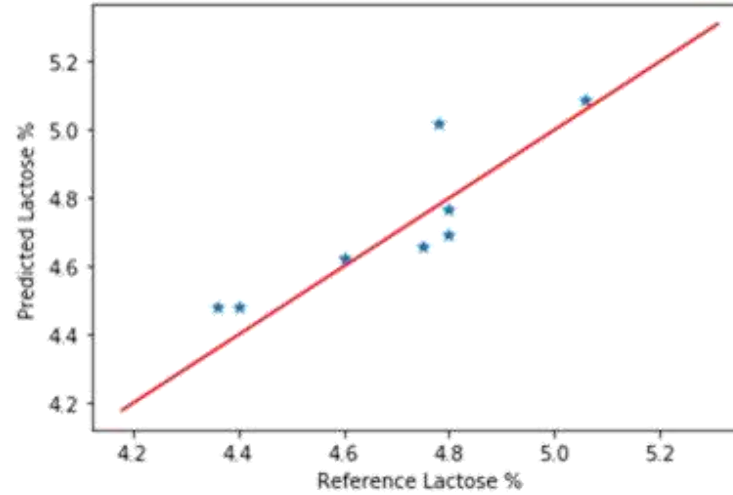
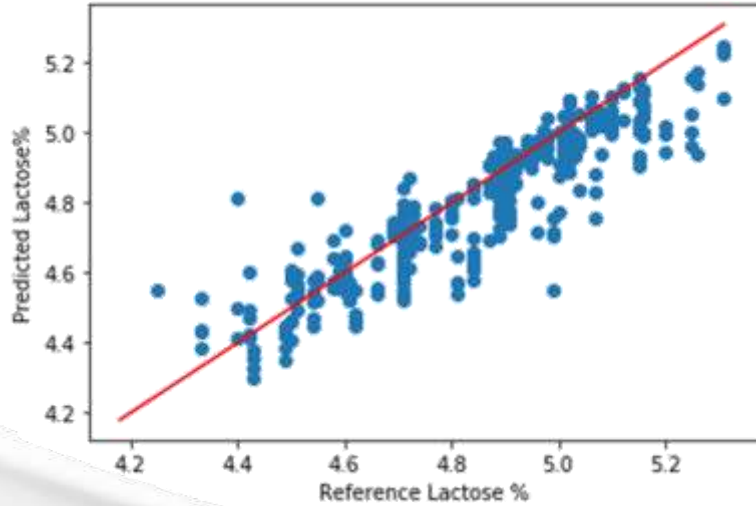
Lactose prediction

Calibration

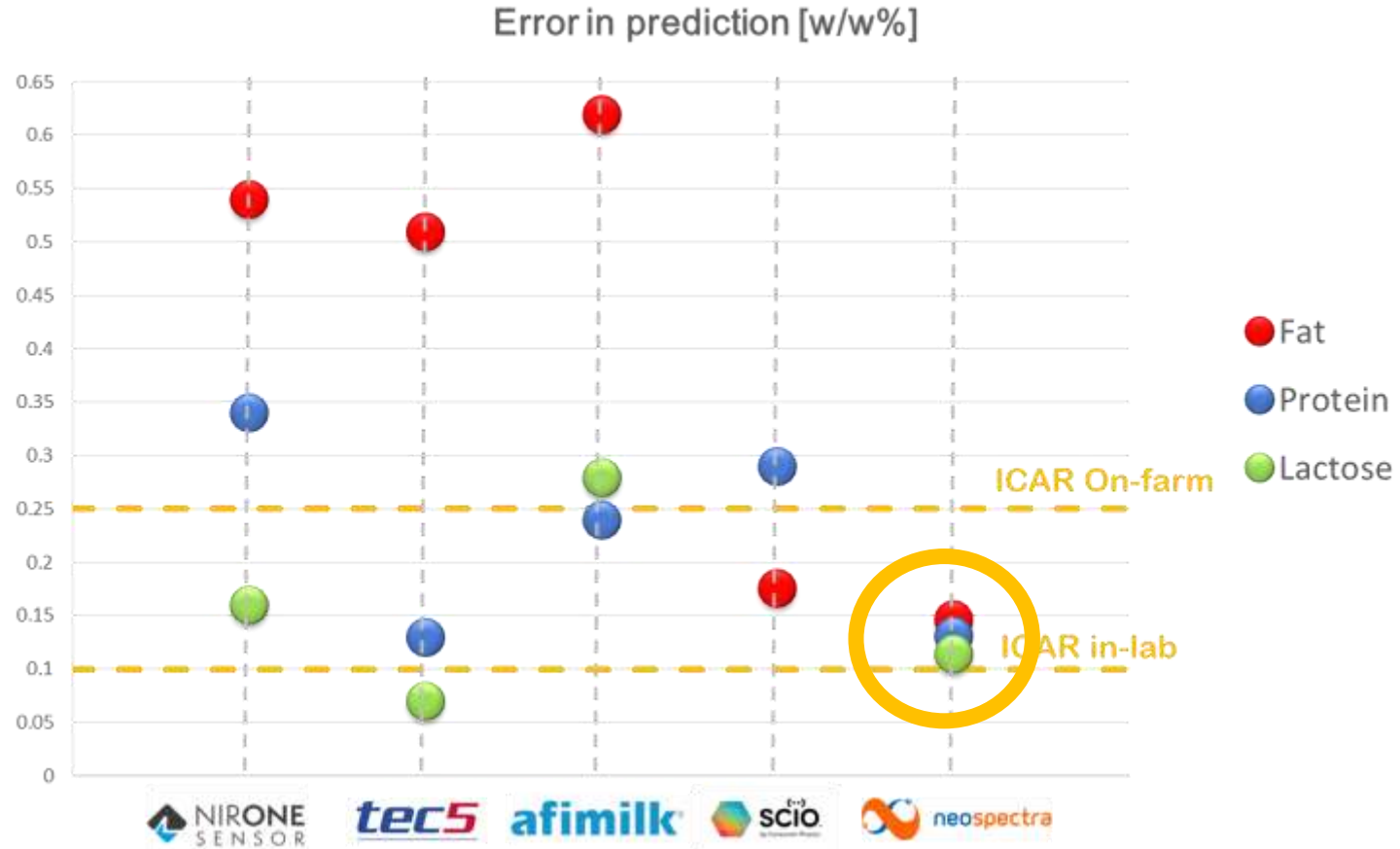
Test

R²=0.818 RMSE=0.105 LV=32 SEP=0.096 Bias= -0.045

R²=0.767 RMSE=0.111 SEP=0.114 Bias= 0.033



Performance comparison



References:

- ICAR Technical Series no. 24 2019: New traits and adding new value to the recording and ID services in the animal production "Comparison of milk analysis performance between NIR laboratory analyser and miniaturised NIR MEMS sensors"
- Riu J, Gorla G, Chakif D, Boqué R, Giussani B. Rapid Analysis of Milk Using Low-Cost Pocket-Size NIR Spectrometers and Multivariate Analysis. *Foods*. 2020; 9(8):1090. <https://doi.org/10.3390/foods9081090>

Demo Time



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NeoSpectra Solution



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From Cow to Cup

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BY TFM