An NIRS Prediction Engine for Discrimination of Animal Feed Ingredients

Aitziber Miguel Oyarbide
Universidad Autónoma de Madrid

Calibration / Validation samples

300 representative samples were taken for calibration and the rest for validation in each of the groups. Kennard-Stone algorithm was used, based on spectral data.

Reason: We want to have a similar number of samples of all the groups and we want them to be representative of their whole group.
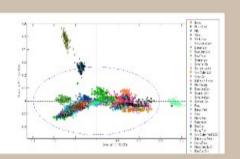
De-Cluttering

- Pre-processing method that is applied to the spectra before performing PCA.

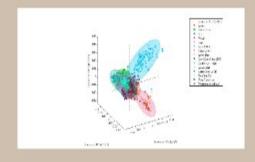- Covariance filter identifies patterns in the variables which should be removed.

- Down-weighing of features that make the data differ.

- Mean centers each class, removes between-class variations and orthogonalises to the clutter subspace.

- It reduces the number of factors required for discriminant modelling.

Prediction Engine

Aim: create an engine which can predict, from a spectra file, which group this spectra belongs to.

- First, we need a classification for each group.

- Based on the classification, models are built for each step when removing groups.

- The engine is built placing these models one after another; they act like filters when a spectra file is entered.

- Engine works in a hierarchical (step-wise) manner.

- Depending on the characteristics of each spectra, the models will guide the files to a final solution, which will be then displayed.

Future Work

- Classification and building of a prediction engine for a larger group of our library.
- Improvement of the accuracy of a prediction engine.
- Extension of the application of the project to all groups in our database.

AUNIR's Library

FEED
Poultry
Ruminant
Swine
Equine
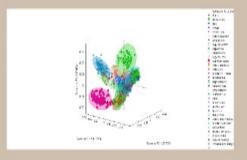Concentrates
Aqua Feed
Pet

FEED INGREDIENTS
Cereals
High Protein High Oil
High Protein Low Oil
Legume
Low Protein High Oil
Low Protein Low Oil
Animal Protein
Milk Powders

Who is AUNIR?

The leading company in NIR calibration development and delivery.

AUNIR provides NIR solutions and calibration requirements for the animal feed industry all over the world.

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FEED	FEED INGREDIENTS
Poultry	Cereals
Ruminant	High Protein High Oil
Swine	High Protein Low Oil
Equine	Legume
Concentrates	Low Protein High Oil
Aqua Feed	Low Protein Low Oil
Pet	Animal Protein
	Milk Powders

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Level 4 — Animal Feed and Ingredients

	Feed Only						Ingredients Only							
Level 3														
Level 2	Poultry Group 1	Ruminants Group 2	Swine Group 3	Equine Group 4	Concentrates Group 5	Aqua Feed Group 6	Cereals Group 10	High Protein High Oil Group 20	High Protein Low Oil Group 30	Legumes Group 40	Low Protein High Oil Group 50	Low Protein Low Oil Group 60	Animal Proteins Group 70	Milk Powders Group 80
Level 1	Broiler	Beef	Finisher Pig	Racehorse	Poultry Concentrate	Fresh Water	Barley	Rape-Pulse Mix	Corn Gluten Feed 60%	Beans	Biscuit Meal High Oil	Citrus	Palm Kernel Low Oil	Fish Meal	Dried Whey Powder
	Chick	Sheep	Gestation Sow	Pony	Broiler Concentrate	Salt Water	Maize (Corn)	Rape Seed Expeller	Cotton Extract	Peas	Maize Germ Meal	Cocoa	Potato Products	Meat and Bone Meal	Skimmed Milk Powder
	Duck	Calf	Grower Pig	Horse	Duck Concentrate		Oats	Soya Full Fat	Groundnut Extract	Lupins	Palm Kernel High Oil	Copra	Rice	Blood and Plasma	Full Cream Milk Powder
	Game	Dairy	Piglet		Layer Concentrate		Triticale	Sunflower Seeds	Linseed Extract	Alfalfa Lucerne	Rice Bran High Oil	Copra Extract	Rice Bran Extract	Feather Meal	
	Goose	Dairy Blends			Ruminant Concentrate		Wheat	Cotton Seed Expeller	Malt Residue			Corn Gluten Feed 20%	Grain Screenings	Poultry By-Products	
	Layers	Lamb			Dairy Concentrate		Red Wheat	Linseed Expeller	Rape Meal Extract			Distillery Low Protein	Sugar Beet	Bone Meal	
	Ostrich	Goat			Blend Concentrate		Sorghum	Whole Rape	Soya Meal Extract			Locust Bean	Wheatfeed Middling	Crab	
	Turkey				Swine Concentrate		Rye	Sesame Expeller	Sunflower Extract			Soya Hulls	Barley Bran	Shrimp	
					Pig Finisher Concentrate			Soybean Expeller	Sesame Meal Extract			Oat Feed	Maize Meal		
					Pig Grower Concentrate			Whole Soybean	Distillery High Protein			Oat Flour	Biscuit Meal Low Oil		
								Whole Linseed				Grass Meal	Maize Germ Meal		
												Hominy	Shea Nut Meal		
												Cassava			

Schedule 4
4.1 (1)

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Calibration / Validation samples

100 representative samples were taken for calibration and the rest for validation in each of the groups. Kennard-Stone algorithm was used, based on spectral data.
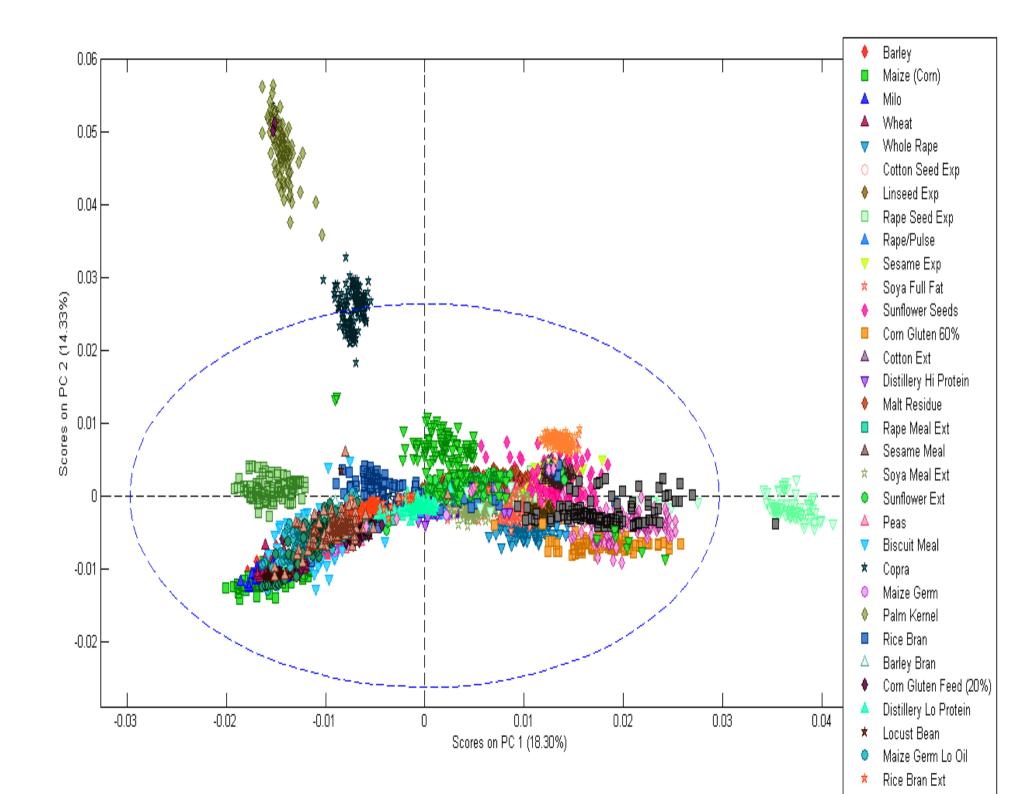
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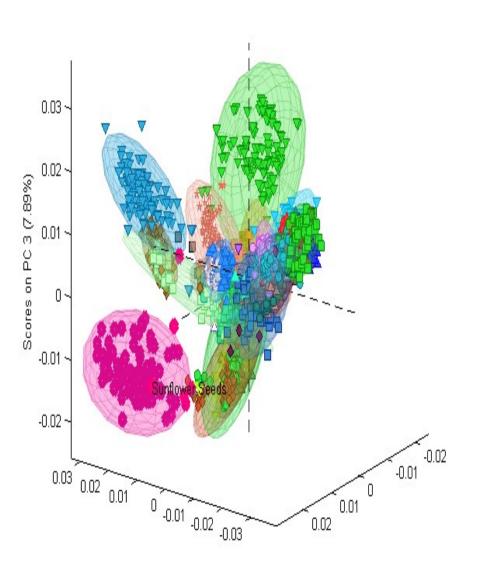
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-Covariance filter: identifies patterns in the variables which should be removed.

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Legend:
- Barley
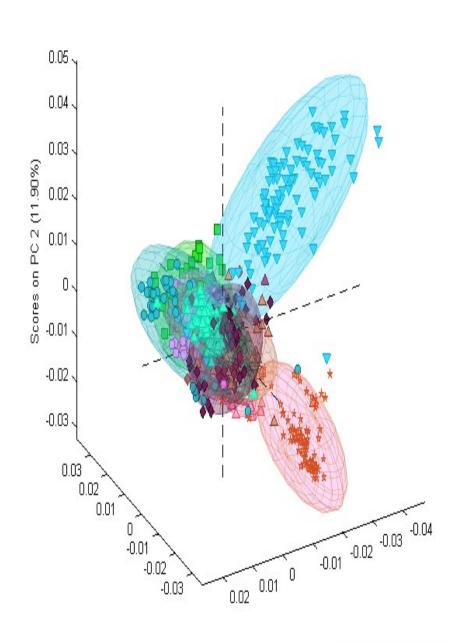- Maize (Corn)
- Milo
- Wheat
- Whole Rape
- Cotton Seed Exp
- Linseed Exp
- Rape Seed Exp
- Rape/Pulse
- Sesame Exp
- Soya Full Fat
- Sunflower Seeds
- Corn Gluten 60%
- Cotton Ext
- Distillery Hi Protein
- Malt Residue
- Rape Meal Ext
- Sesame Meal
- Soya Meal Ext
- Sunflower Ext
- Peas
- Biscuit Meal
- Copra
- Maize Germ
- Palm Kernel
- Rice Bran
- Barley Bran
- Corn Gluten Feed (20%)
- Distillery Lo Protein
- Locust Bean
- Maize Germ Lo Oil
- Rice Bran Ext

Axis labels: Scores on PC 1 (18.30%) — horizontal; Scores on PC 2 (14.33%) — vertical

Scores on PC 3 (7.89%)

Scores on PC 2 (11.24%)

Scores on PC 1 (23.22%)

0.03
0.02
0.01
0
-0.01
-0.02

0.03 0.02 0.01 0 -0.01 -0.02 -0.03

0.02 0.01 0 -0.01 -0.02

Sunflower Seeds

Scores on PC 3 (9.78%)
- Barley
- Maize (Corn)
- Milo
- Wheat
- Peas
- Biscuit Meal
- Maize Germ
- Barley Bran
- Corn Gluten Feed (20%)
- Distillery Lo Protein
- Locust Bean
- Maize Germ Lo Oil
- Rice Bran Ext
- Seed Screenings
- Wheatfeed (middlings)

Scores on PC 2 (11.90%)

Scores on PC 3 (9.78%)

Scores on PC 1 (17.30%)

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-Classification and building of a prediction engine for more groups of our library.

-Improvement of the accuracy of prediction engines.

-Expansion of the application of this project to all groups in our database.

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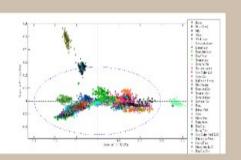
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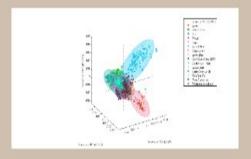- Covariance filter identifies patterns in the variables which should be removed.

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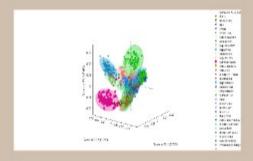Equine
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