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Exercise 5 Tree variable imputation

1) Read “TreeVariableImputation.csv” into R

2) Predict mean diameter (d1.3), height and tree species for each tree using the ALS derived features.

Use k-NN method (R-package yaImpute). Get familiar with the following document Crookston

& Finley (2008) which is in Moodle.

- Test different explanatory variables (x)
- Test different values of k
- Test different strategies to select the nearest neighbours:

o Euclidean distance

o Most similar neighbour (MSN)

3) Analyze the results

- Calculate RMSE and bias
- Plot dependencies between measured and estimated attributes

Return pdf-document which includes your analysis of the achieved results. Analyze, what kind of dependencies were visible between the ALS derived features and field measured tree-level attributes. What were the best explanatory variables (ALS features) for mean diameter and height?

Solution:

Table showing the abbreviations used for the various methods.

NAMING	K	Method for searching kNN	Impute K	Impute method	Impute method factor
euc1	3	euclidean	3	dstWeighted",	median
euc2	5	euclidean	5	dstWeighted	median
euc3	3	euclidean	3	mean	closest
euc4	5	euclidean	5	mean	mean
msn1	3	msn	3	dstWeighted	median
msn2	5	msn	5	dstWeighted	median
msn3	3	msn	3	mean	closest
msn4	5	msn	5	mean	mean
rf	3	randomForest	3	mean	closest

BIAS DIAMETER

	euc1	euc2	euc3	euc4	msn1	msn2	msn3	msn4	rf
diameter bias	5.201636	3.602812	5.342949	0.225918	1.184429	1.184429	0.195513	1.344231	3.301282

BIAS HEIGHT

	euc1	euc2	euc3	euc4	msn1	msn2	msn3	msn4	rf
height bias	0.30105	0.223005	0.312527	0.014044	0.053073	0.053073	0.01583	0.063252	0.171088

CORRELATION

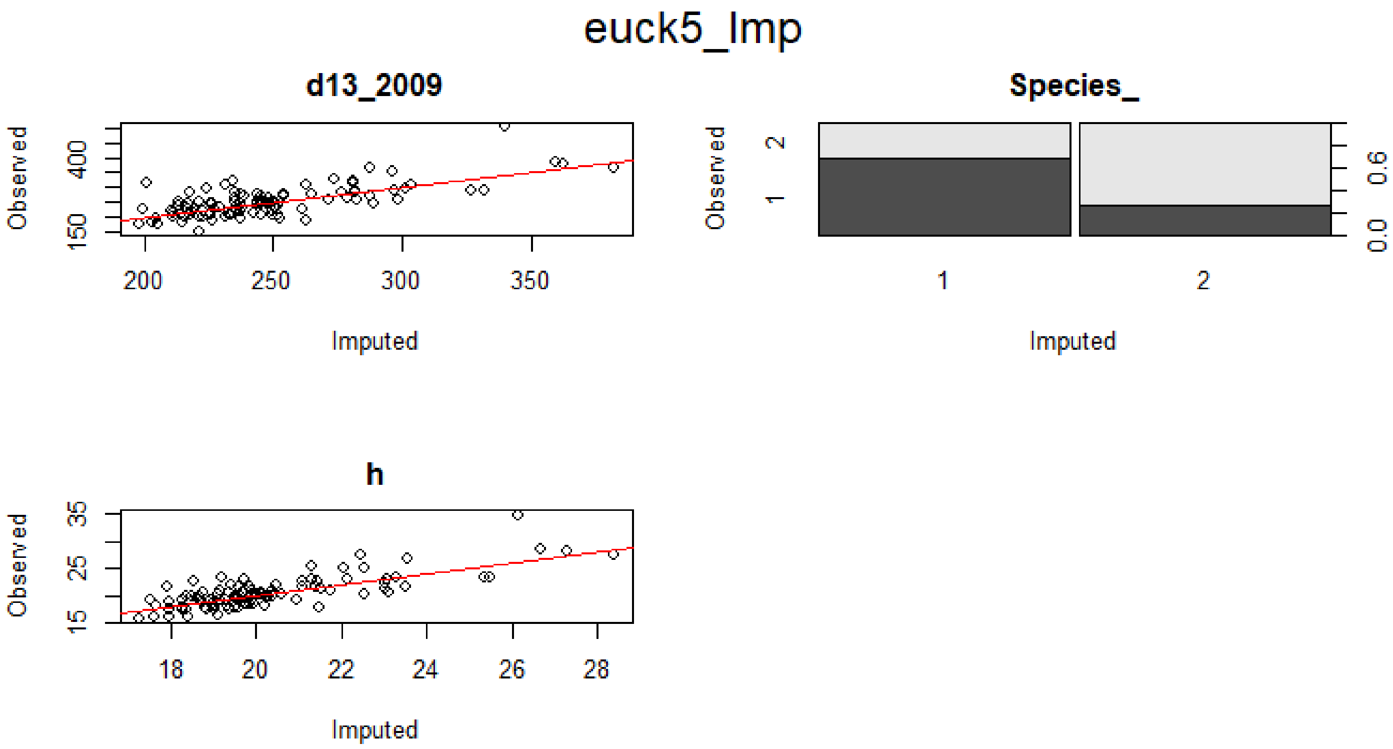
	euc1	euc2	euc3	euc4	msn1	msn2	msn3	msn4	rf
d13_2009	0.700007	0.714972	0.700615	0.709865	0.72576	0.742723	0.725377	0.739163	0.751047
h	0.752019	0.779727	0.756283	0.779215	0.783561	0.802102	0.784839	0.800756	0.794997
Species2	NA	NA	NA	NA	0.433937	0.522126	0.436149	0.527491	NA

RMSD

	euc1	euc2	euc3	euc4	msn1	msn2	msn3	msn4	rf
d13_2009	37.15376	36.15569	37.10373	36.46483	35.92286	34.47041	35.8647	34.66948	34.27145
h	1.964529	1.866156	1.9527	1.87528	1.848551	1.759918	1.839827	1.767138	1.798952
Species2	NA	NA	NA	NA	0.474584	0.433132	0.473665	0.43101	NA

Root Mean Square difference is more preferable to correlation when trying to derive the level of accuracy of prediction (Warren 1971, Nicholas L. Crookston, Andrew O. Finley 2008. Therefore, I based my selection of the prediction method on that with the least error and the bias. From the results, the choice of K value affected the level of accuracy. When applying Euclidean and msn methods, a higher K value of 5 compared to 3, yielded more accurate predictions for both methods.

euc2


euck5_Imp
d13_2009
Observed
150
400
200
250
300
350
Imputed
Species_
Observed
1
2
0.0
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1
2
Imputed
h
Observed
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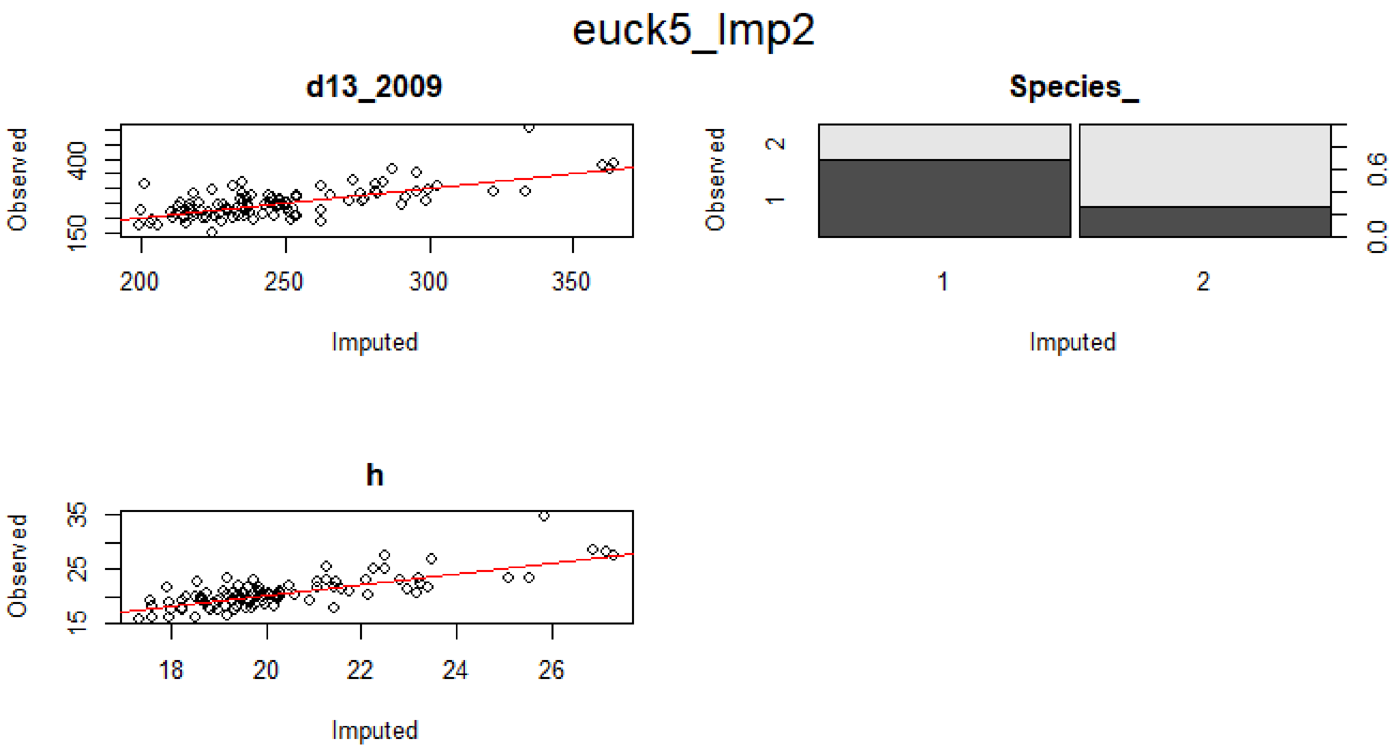
25
35
18
20
22
24
26
28
Imputed

euc4


euck5_Imp2
d13_2009
Observed
150
400
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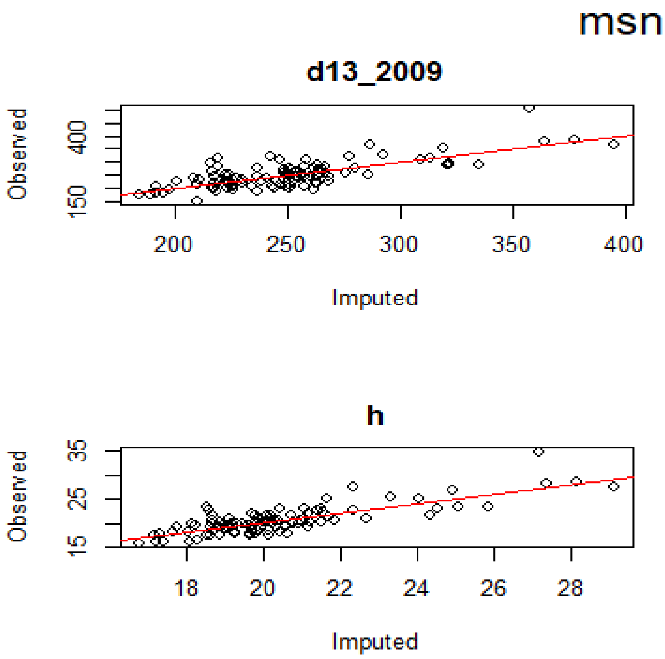
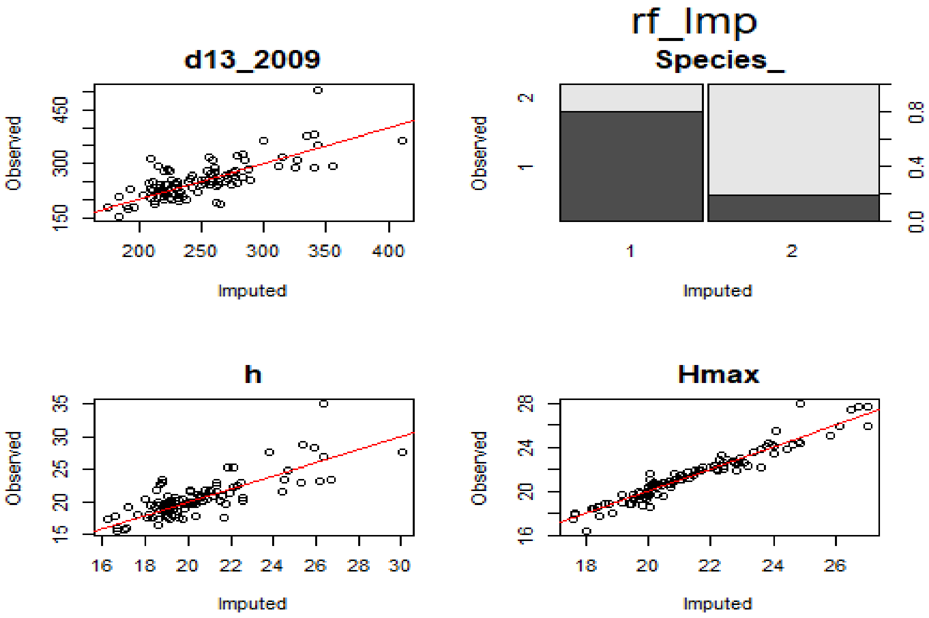
Imputed
Species_
Observed
1
2
0.0
0.6
1
2
Imputed
h
Observed
15
25
35
18
20
22
24
26
Imputed

msn4



rf



The hmax , h90 and hmean appears to be the best explanatory variables. However, I chose the hmax and hmean, as all others seemed to be redundant. There is a deterministic dependency between the ALS features and the field data. The hmax was fair in predicting the height of trees and the diameter and also the species.

Reference(s)

Warren WG (1971). “Correlation or Regression: Bias or Precision.” Applied Statistics, 20(2), 148–164.

Nicholas L. Crookston, Andrew O. Finley, yaImpute: An R Package for kNN Imputation 2008 pg 4

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