

Snow

Kaisa Roggeveen, Scott Graham

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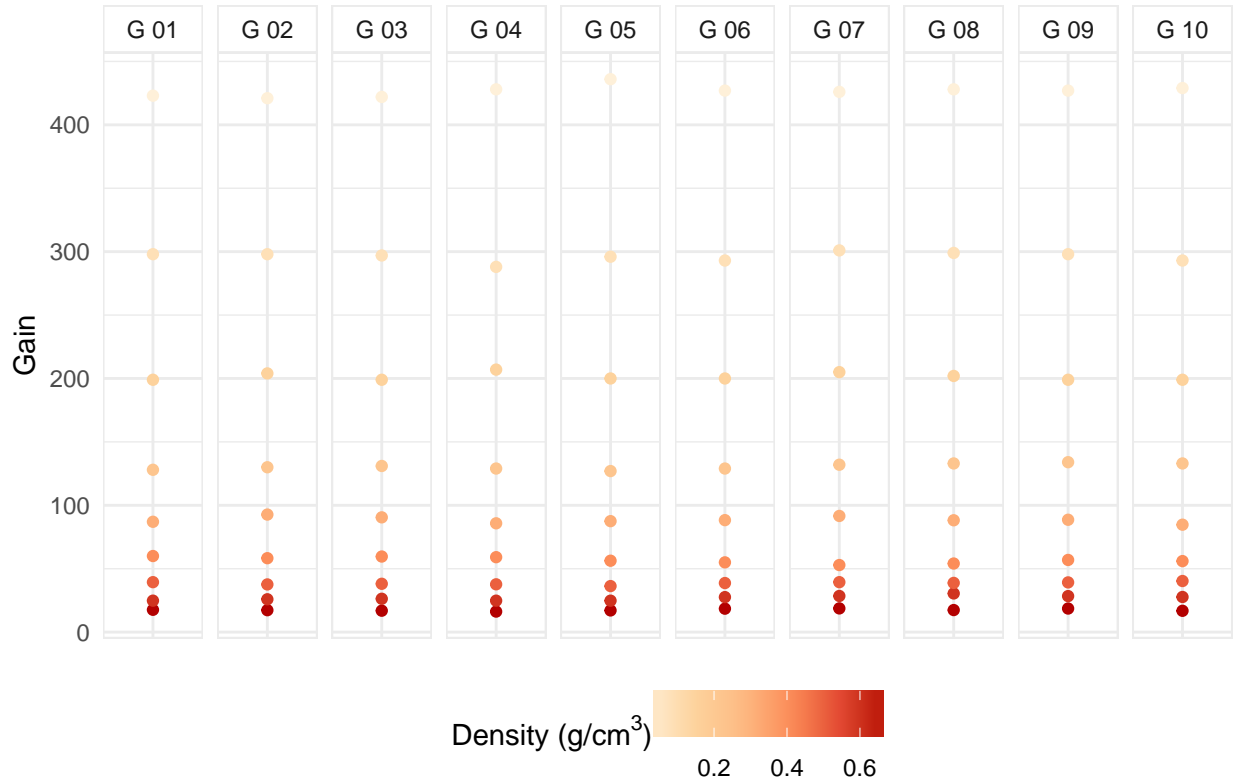
Introduction

Data

Table 1: Wide Data

Density	G 01	G 02	G 03	G 04	G 05	G 06	G 07	G 08	G 09	G 10
0.686	17.6	17.3	16.9	16.2	17.1	18.5	18.7	17.4	18.6	16.8
0.604	24.8	25.9	26.3	24.8	24.8	27.6	28.5	30.5	28.4	27.7
0.508	39.4	37.6	38.1	37.7	36.3	38.7	39.4	38.8	39.2	40.3
0.412	60.0	58.3	59.6	59.1	56.3	55.0	52.9	54.1	56.9	56.0
0.318	87.0	92.7	90.5	85.8	87.5	88.3	91.6	88.2	88.6	84.7
0.223	128.0	130.0	131.0	129.0	127.0	129.0	132.0	133.0	134.0	133.0
0.148	199.0	204.0	199.0	207.0	200.0	200.0	205.0	202.0	199.0	199.0
0.080	298.0	298.0	297.0	288.0	296.0	293.0	301.0	299.0	298.0	293.0
0.001	423.0	421.0	422.0	428.0	436.0	427.0	426.0	428.0	427.0	429.0

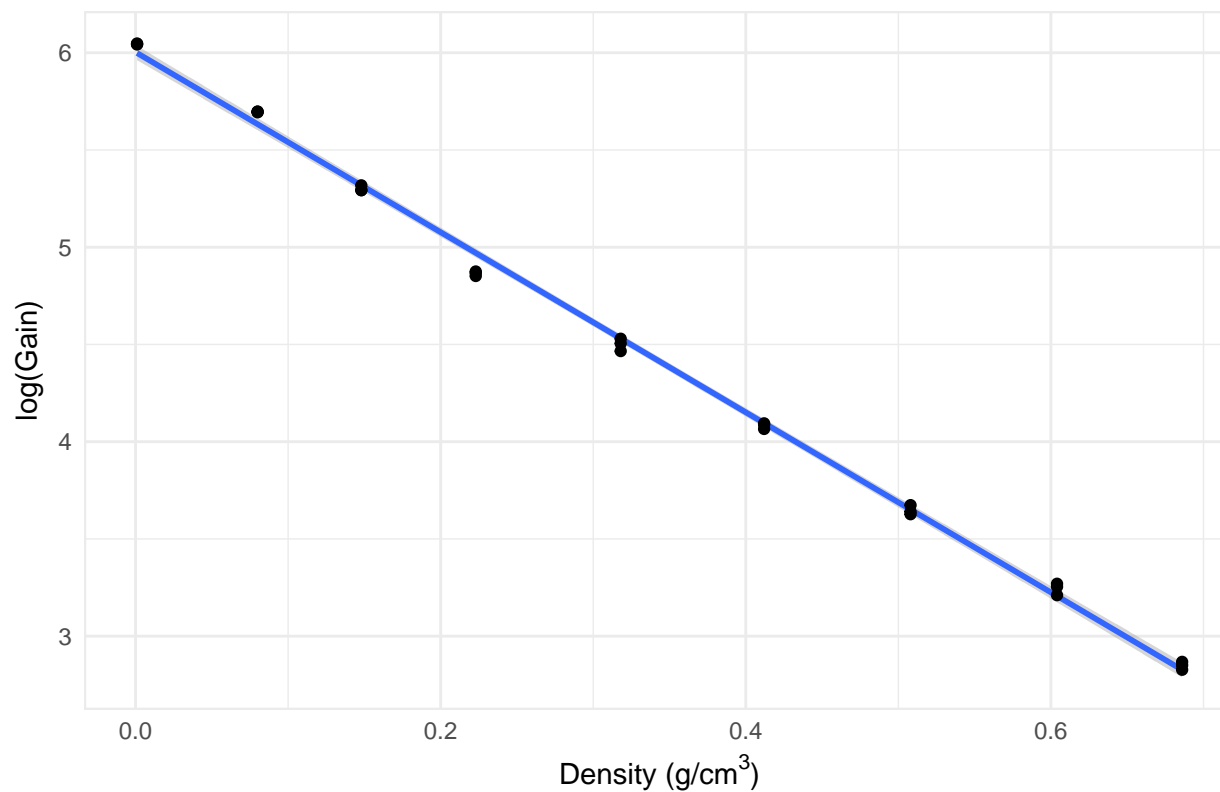
Figure 01: Measured Gain by Gauge



Calibration

Classic Calibration Method

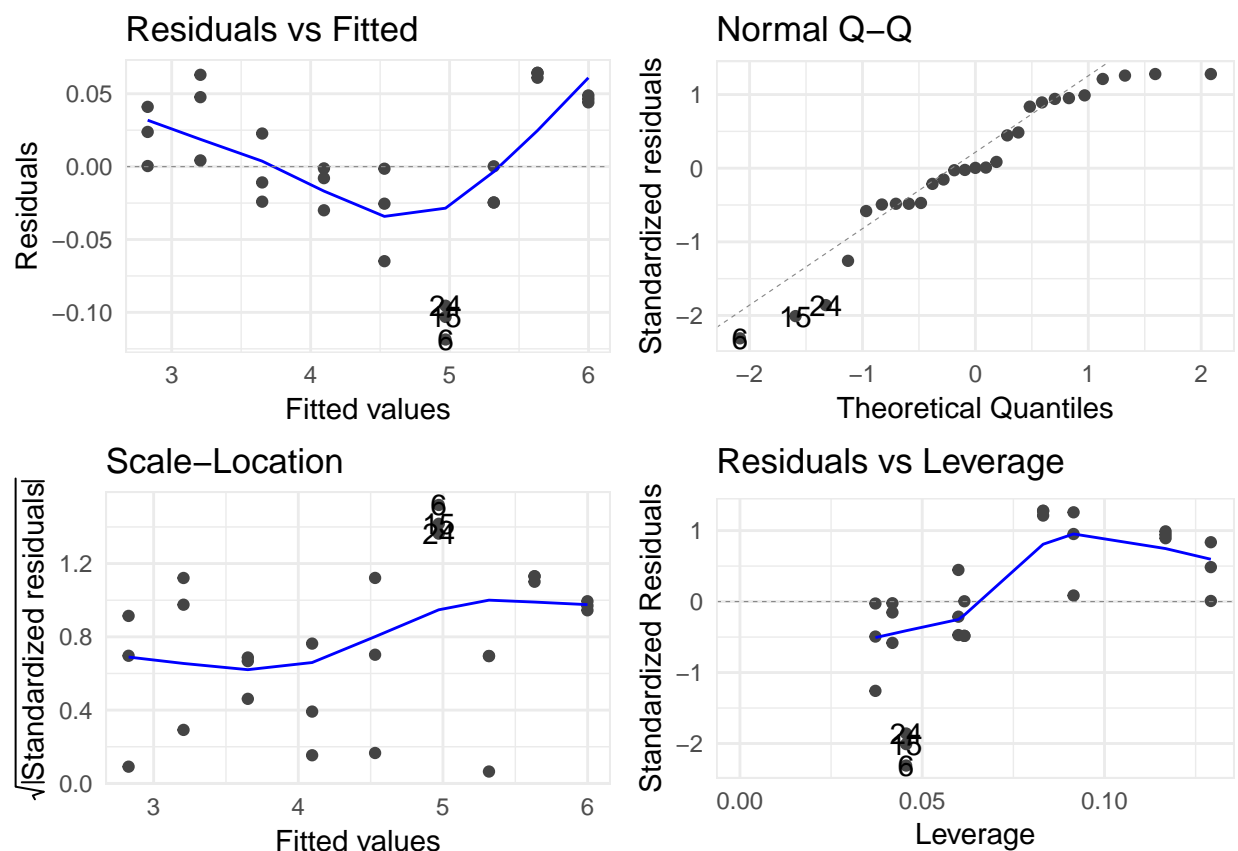
Log Gain vs. Density with Training Data



	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	6.003	0.01799	333.6	3.897e-47
Density	-4.63	0.04495	-103	2.182e-34

Table 3: Fitting linear model: $\log(\text{Gain}) \sim \text{Density}$

Observations	Residual Std. Error	R^2	Adjusted R^2
27	0.05255	0.9976	0.9976



Density	Mean Gain	Est Density	Prediction Std. Error	Prediction LB	Prediction UB
0.001	428.71429	-0.0124462	0.0291207	-0.0415669	0.0166745
0.080	295.42857	0.0679760	0.0270506	0.0409254	0.0950265
0.148	201.71429	0.1503875	0.0253881	0.1249995	0.1757756
0.223	131.00000	0.2436153	0.0241859	0.2194293	0.2678012
0.318	87.81429	0.3300005	0.0238058	0.3061946	0.3538063
0.412	55.75714	0.4281015	0.0242721	0.4038294	0.4523736
0.508	38.62857	0.5073681	0.0253131	0.4820549	0.5326812
0.604	27.47143	0.5809831	0.0267491	0.5542339	0.6077322
0.686	17.61429	0.6769713	0.0291856	0.6477857	0.7061569

Estimated Density vs. Gain

With Prediction Interval and Curve

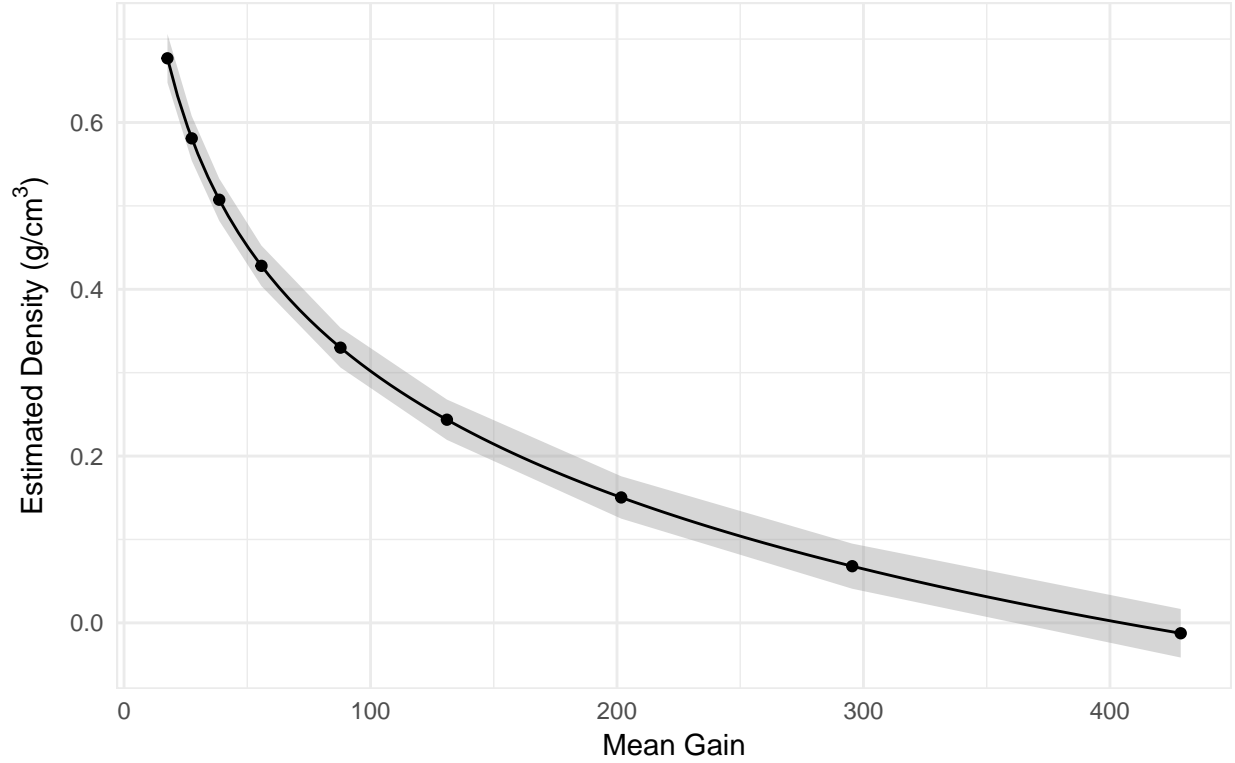


Table 5: Unbiasing the Estimated Density

Density	Est Density	Bias	Unbiased Est Density	Diff
0.001	-0.0124462	-0.0001855	-0.0122607	0.0132607
0.080	0.0679760	-0.0001411	0.0681171	0.0118829
0.148	0.1503875	-0.0001029	0.1504904	-0.0024904
0.223	0.2436153	-0.0000607	0.2436760	-0.0206760
0.318	0.3300005	-0.0000074	0.3300078	-0.0120078
0.412	0.4281015	0.0000454	0.4280560	-0.0160560
0.508	0.5073681	0.0000994	0.5072687	0.0007313
0.604	0.5809831	0.0001533	0.5808297	0.0231703
0.686	0.6769713	0.0001994	0.6767719	0.0092281

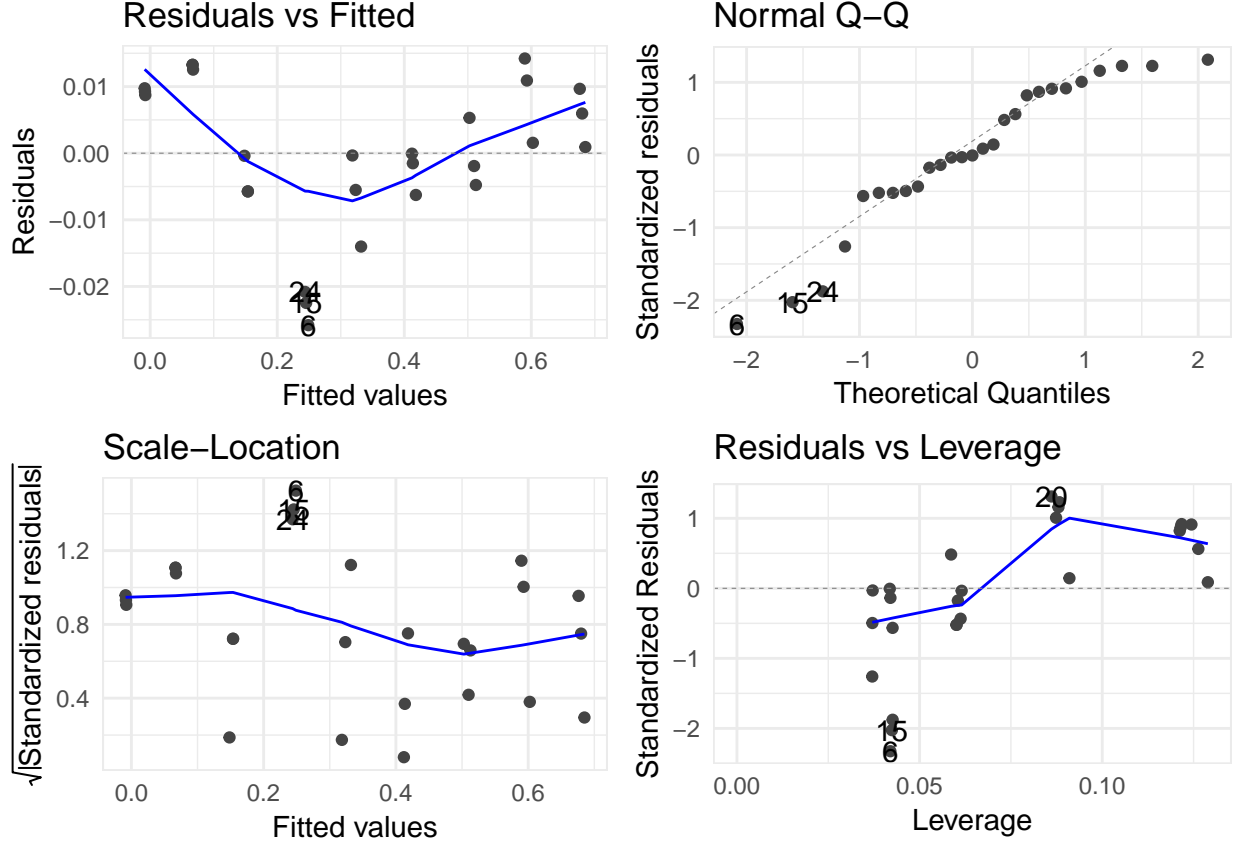
$$D_{pred} = -\frac{\ln(G) - 6.0032}{4.6301} = 1.2965 - 0.2160 \ln(G)$$

Inverse Regression

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	0.3311	0.002182	151.8	1.375e-38
log(Centred Gain)	-0.2155	0.002092	-103	2.182e-34

Table 7: Fitting linear model: Density $\sim \log(\text{Centred Gain})$

Observations	Residual Std. Error	R^2	Adjusted R^2
27	0.01134	0.9976	0.9976



$$D = \gamma_0 + \gamma_1 \left(\ln(G) - \overline{\ln(G)} \right) 0.3311 - 0.2155 (\ln(G) - 4.4701)$$

$$\overline{\ln(G)} = \sum_{i=1}^n \frac{\ln G_i}{n}, \gamma_0 = \bar{D}$$

Density	Mean Gain	Mean Centred Gain	Est Density	Prediction Std. Error	Prediction LB	Prediction UB
0.001	428.71429	4.9072264	-0.0116386	0.0431654	-0.0548040	0.0315268
0.080	295.42857	3.3815876	0.0685945	0.0364245	0.0321701	0.1050190
0.148	201.71429	2.3088983	0.1508124	0.0304059	0.1204064	0.1812183
0.223	131.00000	1.4994757	0.2438210	0.0254865	0.2183344	0.2693075
0.318	87.81429	1.0051556	0.3300031	0.0237781	0.3062250	0.3537811
0.412	55.75714	0.6382174	0.4278735	0.0258616	0.4020119	0.4537351
0.508	38.62857	0.4421573	0.5069538	0.0301162	0.4768375	0.5370700
0.604	27.47143	0.3144484	0.5803957	0.0353825	0.5450132	0.6157782
0.686	17.61429	0.2016198	0.6761583	0.0433671	0.6327912	0.7195254

Estimated Density vs. Gain

With Prediction Interval and Curve

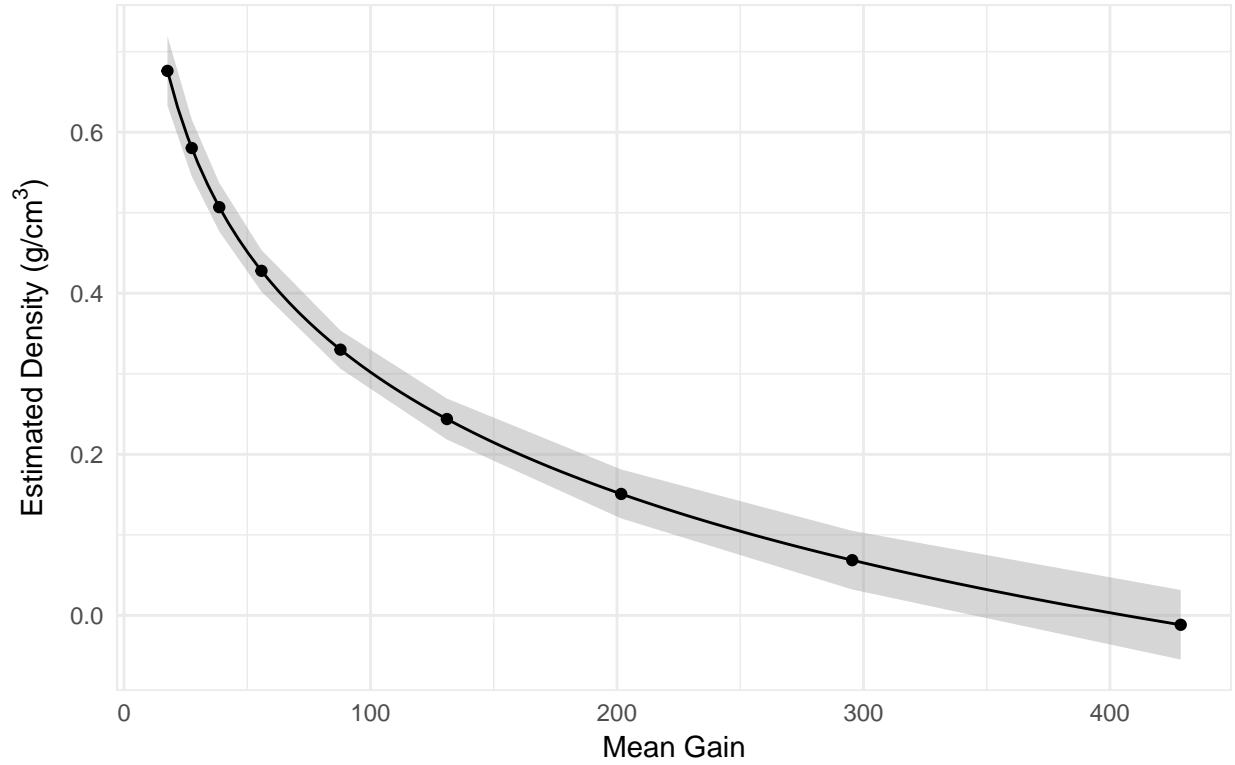


Table 9: Unbiasing the Estimated Density

Density	Est Density	Bias	Unbiased Est Density	Diff
0.001	-0.0116386	0.0169938	-0.0286324	0.0296324
0.080	0.0685945	0.0129270	0.0556675	0.0243325
0.148	0.1508124	0.0094264	0.1413860	0.0066140
0.223	0.2438210	0.0055655	0.2382555	-0.0152555
0.318	0.3300031	0.0006749	0.3293281	-0.0113281
0.412	0.4278735	-0.0041641	0.4320376	-0.0200376
0.508	0.5069538	-0.0091061	0.5160598	-0.0080598
0.604	0.5803957	-0.0140481	0.5944438	0.0095562
0.686	0.6761583	-0.0182693	0.6944276	-0.0084276

Comparison

Density	CC Est Density	CC Bias	IR Est Density	IR Bias
0.001	-0.0124462	-0.0001855	-0.0116386	0.0169938
0.080	0.0679760	-0.0001411	0.0685945	0.0129270
0.148	0.1503875	-0.0001029	0.1508124	0.0094264
0.223	0.2436153	-0.0000607	0.2438210	0.0055655
0.318	0.3300005	-0.0000074	0.3300031	0.0006749
0.412	0.4281015	0.0000454	0.4278735	-0.0041641
0.508	0.5073681	0.0000994	0.5069538	-0.0091061

Density	CC Est Density	CC Bias	IR Est Density	IR Bias
0.604	0.5809831	0.0001533	0.5803957	-0.0140481
0.686	0.6769713	0.0001994	0.6761583	-0.0182693

Density	Mean Gain	CC Est Density	CC Prediction Std. Error	IR Est Density	IR Prediction Std. Error
0.001	428.71429	-0.0124462	0.0291207	-0.0116386	0.0431654
0.080	295.42857	0.0679760	0.0270506	0.0685945	0.0364245
0.148	201.71429	0.1503875	0.0253881	0.1508124	0.0304059
0.223	131.00000	0.2436153	0.0241859	0.2438210	0.0254865
0.318	87.81429	0.3300005	0.0238058	0.3300031	0.0237781
0.412	55.75714	0.4281015	0.0242721	0.4278735	0.0258616
0.508	38.62857	0.5073681	0.0253131	0.5069538	0.0301162
0.604	27.47143	0.5809831	0.0267491	0.5803957	0.0353825
0.686	17.61429	0.6769713	0.0291856	0.6761583	0.0433671