

Gradient SMM

To find a model that fits the population well, we will use the log-likelihood of N Bernoulli trials with varying probability of success. Here we will fit the model given by the above equation via gradient descent.

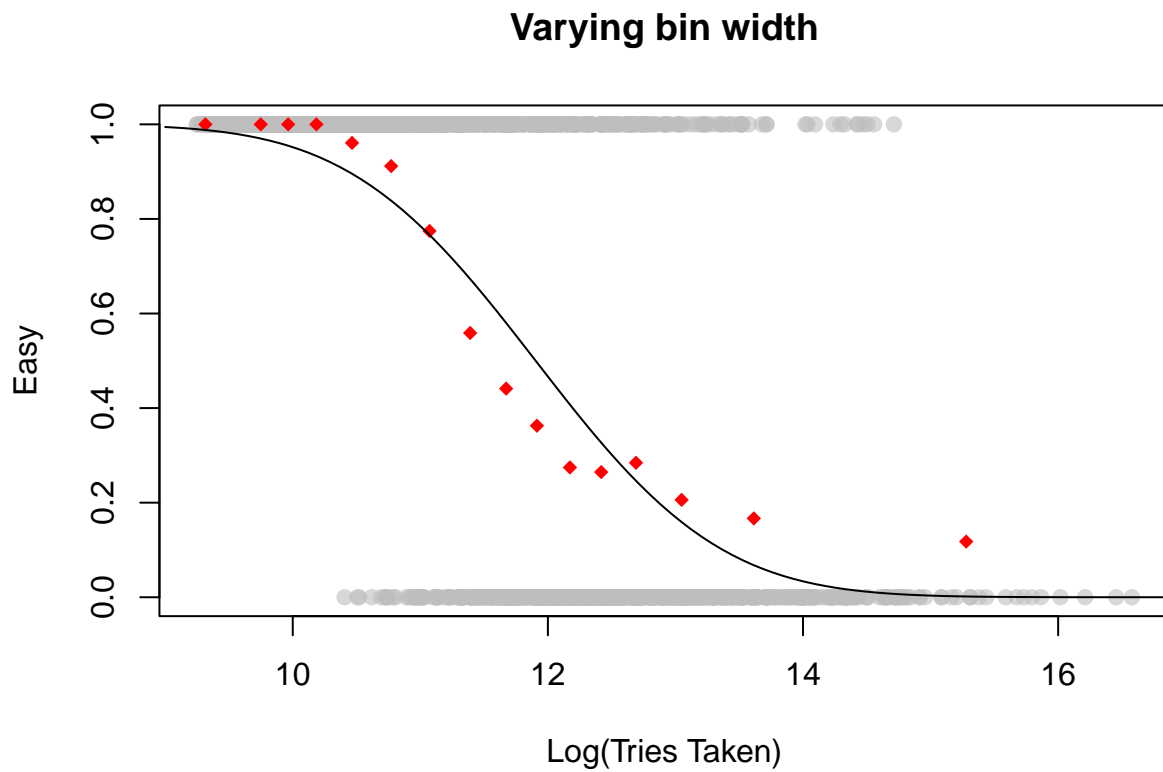
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# #####  
# REDACTED  
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We perform gradient descent until convergence.

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Now, we will assess the fitted model.

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We compare the fitted values from the model to the points added to the plot.

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```

##	lower	upper	num_levels	num_easy_levels	prop	prop2
## 1	9.000000	9.630431	102	102	1.0000000	0.988096426
## 2	9.630431	9.867705	102	102	1.0000000	0.970046272
## 3	9.867705	10.060705	102	102	1.0000000	0.954835012
## 4	10.060705	10.309985	102	102	1.0000000	0.933271018
## 5	10.309985	10.619765	102	98	0.9607843	0.895546110
## 6	10.619765	10.923147	102	93	0.9117647	0.838651180
## 7	10.923147	11.221088	102	79	0.7745098	0.766219146
## 8	11.221088	11.560038	102	57	0.5588235	0.673085410
## 9	11.560038	11.785217	102	45	0.4411765	0.580122414
## 10	11.785217	12.043048	102	37	0.3627451	0.496558340
## 11	12.043048	12.302582	102	28	0.2745098	0.407315166
## 12	12.302582	12.533111	102	27	0.2647059	0.326943247
## 13	12.533111	12.848332	102	29	0.2843137	0.246170792
## 14	12.848332	13.248395	102	21	0.2058824	0.158943218
## 15	13.248395	13.980168	102	17	0.1666667	0.067737298
## 16	13.980168	16.578554	102	12	0.1176471	0.001607111

The implicit assumption behind the parametric model and non-parametric model is that the non-parametric model assumes constant difficulty proportions over each interval. The parametric model assumes monotonic increasing or decreasing difficulty proportion.