Supplementary Handout

Supplementary material that didn't fit on the poster.

Data Scraping

We scraped Rotten Tomatoes data using "urllib2" and "re".

We tried a variety of different methods in order to scrape data from metacritic but there wasn't much success. A few of the methods we tried included:

Scraping directly from metacritic.

Failed because metacritic blocks requests made via urllib in python.

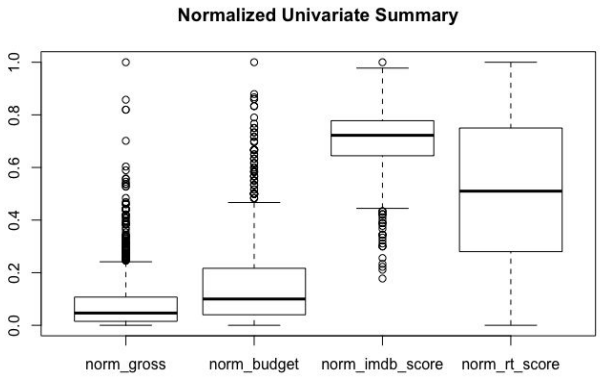
Potentially there are other scraping methods that could circumvent this if we could set up the GET request properly in html (after all, it serves requests made from web browsers).

Scraping from search engine results (google).

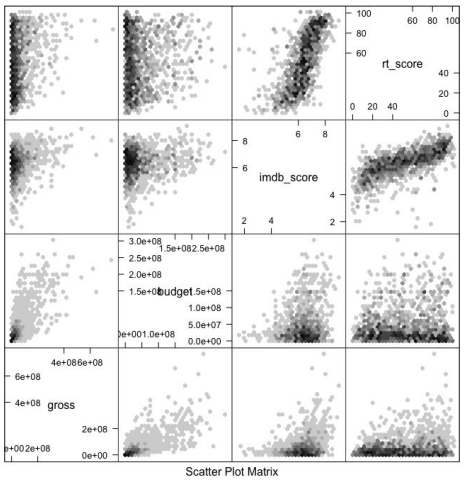
This didn't work because google blocks your IP after a certain number of requests. Potentially using a timer and scraping at random intervals (perhaps Poisson would be best) could circumvent this.

Exploratory Analysis

Univariate summaries.



Scatter plot matrix for our continuous random variables.



Initial Regression Result

Call:

lm(formula = gross ~ ., data = data_initial)

Residuals:

Min	1Q	Median	3Q	Max
-236630412	-26076779	-7207365	16453032	460557534

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	-5.838e+07	1.291e+07	-4.521	6.72e-06	***
budget	1.097e+00	4.062e-02	27.001	< 2e-16	***
imdb_score	8.658e+06	2.159e+06	4.011	6.40e-05	***
Adventure	-7.292e+06	5.172e+06	-1.410	0.15884	
Animation	5.613e+06	7.699e+06	0.729	0.46610	
Biography	5.138e+06	7.348e+06	0.699	0.48450	
Comedy	8.833e+06	4.102e+06	2.153	0.03147	*
Crime	-6.446e+06	4.799e+06	-1.343	0.17940	
Documentary	-1.827e+07	1.093e+07	-1.672	0.09470	.
Drama	-1.121e+07	3.901e+06	-2.872	0.00414	**
Family	-4.552e+06	6.022e+06	-0.756	0.44989	
Fantasy	-7.261e+05	4.776e+06	-0.152	0.87918	
History	-7.774e+06	1.020e+07	-0.762	0.44618	
Horror	6.477e+06	5.873e+06	1.103	0.27030	
Music	1.009e+07	7.389e+06	1.365	0.17239	
Musical	-2.715e+06	1.039e+07	-0.261	0.79394	
Mystery	-1.456e+06	5.668e+06	-0.257	0.79738	
Romance	8.988e+05	4.117e+06	0.218	0.82724	
Sci.Fi	6.495e+06	5.093e+06	1.275	0.20244	
Sport	-8.764e+06	7.761e+06	-1.129	0.25900	
Thriller	-8.084e+05	4.422e+06	-0.183	0.85498	
War	7.136e+06	9.634e+06	0.741	0.45901	
Western	-1.459e+07	1.529e+07	-0.954	0.34037	
rt_score	3.673e+05	7.802e+04	4.707	2.78e-06	***
2007	-3.844e+06	6.807e+06	-0.565	0.57239	
2008	-3.283e+06	6.523e+06	-0.503	0.61488	
2009	1.060e+06	6.516e+06	0.163	0.87085	
2010	-3.376e+06	6.608e+06	-0.511	0.60949	
2011	-7.857e+06	6.692e+06	-1.174	0.24055	
2012	3.803e+06	6.644e+06	0.572	0.56719	
2013	-5.225e+06	6.712e+06	-0.779	0.43638	
2014	3.953e+06	6.754e+06	0.585	0.55845	
2015	2.968e+06	7.045e+06	0.421	0.67357	

Residual standard error: 54160000 on 1296 degrees of freedom

Multiple R-squared: 0.5759, Adjusted R-squared: 0.5655

F-statistic: 55 on 32 and 1296 DF, p-value: < 2.2e-16

Transformations

bcPower Transformations to Multinormality

	Est.Power	Std.Err.	Wald Lower Bound	Wald Upper Bound
Y1	0.2952	0.0109	0.2739	0.3165
Y2	0.2543	0.0139	0.2270	0.2816
Y3	2.4339	0.1108	2.2167	2.6510
Y4	0.9676	0.0467	0.8761	1.0590

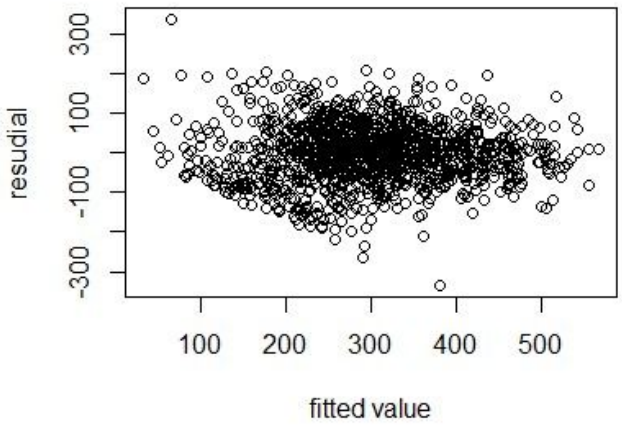
Likelihood ratio tests about transformation parameters

	LRT	df	pval
LR test, lambda = (0 0 0 0)	2995.474884	4	0.0000000
LR test, lambda = (1 1 1 1)	3899.397058	4	0.0000000
LR test, lambda = (0.3 0.25 2.43 1)	0.480411	4	0.9753797

So we used lambda = (0.25, 0.25, 2, 1), where Y1 is gross, Y2 is budget, Y3 is imdb score and Y4 is rotten tomatoes score.

Censor Results

Based on the residual plot for our final model, there seems to be a lower bound in the lower left corner which could be due to the natural censor for our dependent variable. So we fit a tobit regression model.



Observations:

Total	Left-censored	Uncensored	Right-censored
1330	1	1329	0

(Note that we augmented with one zero variable since we didn't actually have any movies that had exactly zero gross)

Coefficients:

	Estimate	Std. error	t value	Pr(> t)
(Intercept)	-231.20984	809.64485	-0.286	0.775208
data_c6$t_budget	0.98660	0.02607	37.842	< 2e-16 ***
data_c6$t_imdb_score	-73.96865	14.03893	-5.269	1.37e-07 ***
data_c6$t_rt_score	13.94225	3.45777	4.032	5.53e-05 ***
data_c6$t_imdb_score2	6.93755	1.20982	5.734	9.79e-09 ***
data_c6$year2006	417.36904	810.73131	0.515	0.606689
data_c6$year2007	408.58067	810.74172	0.504	0.614290
data_c6$year2008	411.47693	810.73384	0.508	0.611779
data_c6$year2009	413.09014	810.74759	0.510	0.610389
data_c6$year2010	415.86186	810.75224	0.513	0.607998
data_c6$year2011	414.22537	810.74352	0.511	0.609407
data_c6$year2012	430.19563	810.75734	0.531	0.595689
data_c6$year2013	430.27326	810.75374	0.531	0.595621
data_c6$year2014	438.50428	810.75073	0.541	0.588603
data_c6$year2015	421.68073	810.76120	0.520	0.602991
data_c6$c6_1	16.52826	4.86652	3.396	0.000683 ***
data_c6$c6_2	-4.68529	4.72530	-0.992	0.321426
data_c6$c6_3	-20.48595	6.69707	-3.059	0.002221 **
data_c6$c6_4	-4.30921	5.14010	-0.838	0.401834
data_c6$c6_5	-6.84014	5.39199	-1.269	0.204592
data_c6$c6_6	25.45859	6.05539	4.204	2.62e-05 ***
logSigma	4.28595	0.01940	220.966	< 2e-16 ***

Newton-Raphson maximisation, 16 iterations

Return code 2: successive function values within tolerance limit

Log-likelihood: -7581.796 on 22 Df

The only coefficients that really differ are the year factors and the intercept. All of the covariates of interest don't change in value.

Regression Without Outliers and Influential Points

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-5.218e+03	1.438e+03	-3.629	0.000295 ***
t_budget	9.918e-01	2.584e-02	38.384	< 2e-16 ***
t_imdb_score	-8.160e+01	1.434e+01	-5.689	1.57e-08 ***
t_rt_score	1.253e+01	3.434e+00	3.649	0.000273 ***
t_imdb_score2	7.616e+00	1.226e+00	6.210	7.11e-10 ***
Year	2.698e+00	7.161e-01	3.768	0.000172 ***
c6_1	1.751e+01	4.827e+00	3.628	0.000297 ***
c6_2	-3.781e+00	4.689e+00	-0.806	0.420210
c6_3	-1.970e+01	6.609e+00	-2.980	0.002933 **
c6_4	-3.737e+00	5.093e+00	-0.734	0.463251
c6_5	-7.705e+00	5.331e+00	-1.445	0.148611
c6_6	2.547e+01	6.009e+00	4.239	2.40e-05 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 72.1 on 1314 degrees of freedom

Multiple R-squared: 0.6317, Adjusted R-squared: 0.6286

F-statistic: 204.9 on 11 and 1314 DF, p-value: < 2.2e-16