HW5 – Solution/Rubric

(a)

Grading criteria:

- **1 point**: 807 songs
- **1 point:** 2421 users
- **1 point:** ratings range from 1 to 3.433
- **2 points:** For splitting the data into 84:4:4:8 and construct an incomplete training set ratings matrix

(b)

(i)

Grading criteria:

- **3 points**: Number of parameters: 807+2421=3228
- **2 points:** Number of observations in training set: 243104

(ii)

Grading criteria:

- **5 points:** Explain in words that the songs with the larges three β_j are the thee most popular songs after removing for the bias due to how particular users
- **5 points:** For providing songs information:

songID	songName	year	artist	genre	beta
54	You're The One	1990	Dwight Yoakam	Country	1.73
26	Undo	2001	Bjork	Rock	1.69
439	Secrets	2009	OneRepublic	Rock	1.64

(iii)

Grading criteria:

- **5 points:** For proving the three user IDs

userID	alpha
1540	0.605
838	0.508

1569 0.504

(iv)

Before normalization:

MAE = 0.1799234
RMSE = 0.2360072
OSR2 = 0.2830456

After normalization by 2.433:

MAE = 0.07395124
RMSE = 0.09700256
OSR2 = 0.2830456

Grading criteria:

- **Full credit if normalize by 2.433/3.**
- **Full credit if no normalization.**
- **4 points:** For getting OSR2 right;
- **3 points each for the other two.**

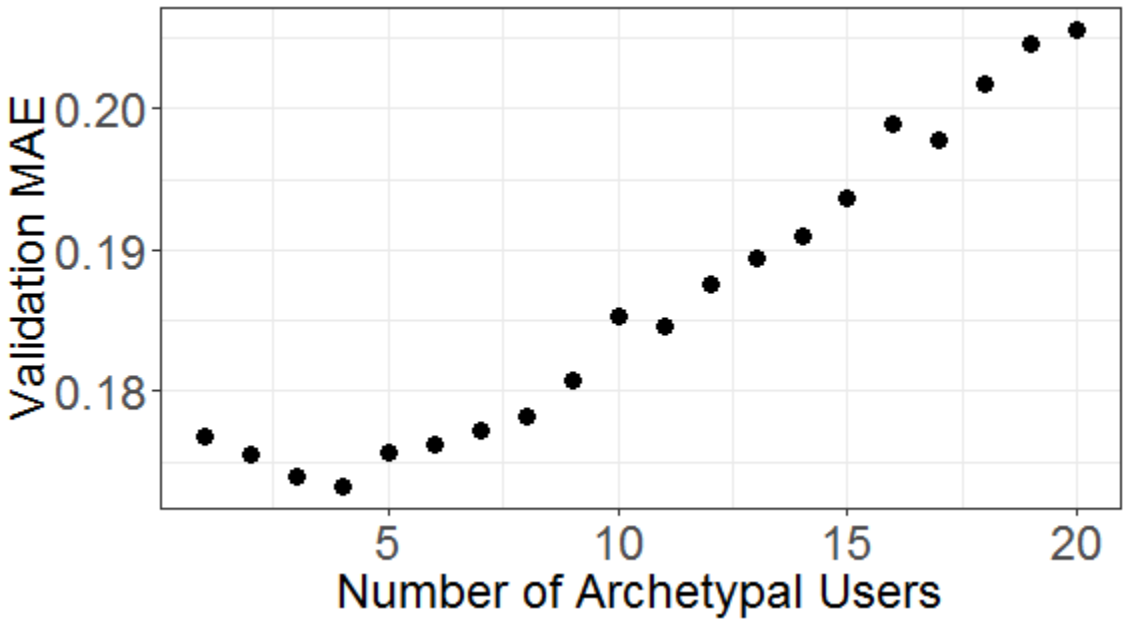
(c)

(i)
Grading criteria:

- **8 points**: Number of parameters: 807+2421 + 807*k + 2421*k=3228*(k+1); Give **2** points if said 3228+807*2421 instead
- **2 points:** Number of observations in training set: 243104

(ii)

We trained models with k from 1 to 20, and evaluate their performance on the validation set A. We chose k=4 as it has the lowest MAE on validation set A (the other metrics can also be used).



Grading criteria:

- **5 points**: For explanation of the procedure for selecting k.
- **8 points:** For justification by plot
- **2 points:** For getting k correct (full credit if getting a slightly different plot and choose a different k that have lowest Validation MAE/ other metrics are also fine).
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(iii)

Before Normalize:

mae = 0.1725403
rmse = 0.2328541
osr2 = 0.3020751

After normalizing by 2.433:

mae = 0.0709167
rmse = 0.09570657
osr2 = 0.3020751

Grading criteria:

- **4 points:** For getting one of the three metrics right;
- **3 points each for the other two.**
- **Full credit if no normalization or normalized using 2.433/3.**

(d)(i)

linear model:

Before Normalize:

mae =0.223619
rmse =0.274461
osr2=0.03037852
After normalizing by 2.433:

mae/2.433=0.09191079
rmse/2.433=0.1128076
osr2=0.03037852

Random Forest:

Before Normalize:

mae=0.224083
rmse=0.2738696
osr2=0.03455283
After normalize by 2.433:

mae/2.433=0.0921015
rmse/2.433=0.1125646
osr2=0.03455283

Grading criteria:

- **3 points : use correct features and build two reasonable models**
- **2 points each:** reasonable mae, rmse and osr2for each model
    - **Full credit if no normalization or normalized using 2.433 or 3.**

(ii)

Before normalization:

mae=0.1757015
rmse=0.2297051
osr2=0.320824

After normalization by 2.433:

mae/2.433=0.072216
rmse/2.433=0.0944123
osr2=0.320824

	MAE	**RMSE**	**OSR2**
cf	0.07203779	0.09570657	0.3020751
lm	0.09191079	0.1128076	0.03037852
rf	0.0921015	0.1125646	0.03455283
bld	0.072216	0.0944123	0.320824

The blended model has second lowest mae (very close to the lowest), lowest rmse and highest osr2. Generally, it is the best model. We also observe that it only outperforms cf model by a little bit, hence adding features to the cf model only add some, but not much predictive power.

Grading criteria:

- **4 points : building the blending model correctly**
- **2 points each:** reasonable mae, rmse and osr2
    - **Full credit if no normalization or normalized using 2.433 or 3.**
- **5 points:** for reasonable justification of whether the additional features add predictive power