



Reaching beyond the Stars

in recommending Thai Restaurants in Las Vegas

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Problem Definition

Task: *Classify a Thai restaurant in Las Vegas that is new to a user as a restaurant to be experienced (or not).*



Experience: *Two datasets, including the Yelp academic business and review (user ratings and reviews).*

Performance: *Classification accuracy
(1) the restaurant RATING predicted
(2) the SENTIMENT SCORE predicted.*



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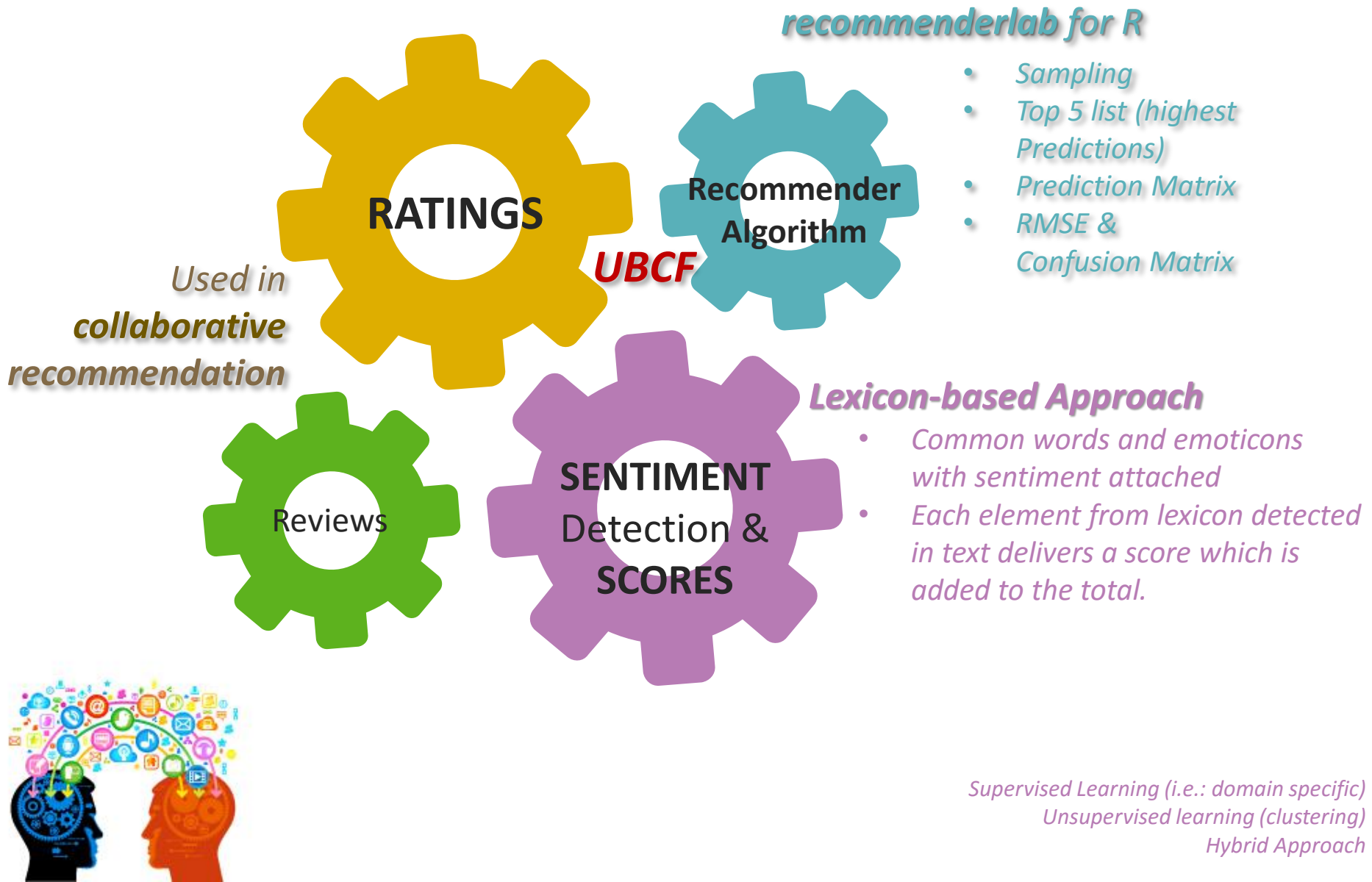
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Dataset Description

Reviews:

1,569,264 reviews / 990,627 *restaurant reviews* / 434,491 restaurant reviews given unique reviewers of restaurants in Phoenix / **405,760 restaurant reviews in Las Vegas** / **42,123 restaurant reviews in Las Vegas given unique reviewers of restaurants in Phoenix** / **1,266 reviews of Thai restaurants in Las Vegas given unique reviewers of restaurants in Phoenix** /// 9,850 reviews of Thai restaurants in Phoenix given unique reviewers of restaurants in Phoenix / *11,428 reviews of Thai restaurants given unique reviewers of restaurants in Phoenix* / 10,911 reviews combined by unique users of Thai restaurants given unique reviewers of restaurants in Phoenix.

Businesses:

61,184 businesses / 21,892 *restaurants* / 21,799 restaurants with reviews / **4,960 restaurants in Las Vegas** / **3,837 restaurants in Las Vegas reviewed by unique reviewers of restaurants in Phoenix** / **106 Thai restaurants in Las Vegas reviewed by unique reviewers of restaurants in Phoenix** /// 131 Thai restaurants in Phoenix reviewed by unique reviewers of restaurants in Phoenix / *319 Thai restaurants reviewed by unique reviewers of restaurants in Phoenix*.

Users:

366,715 users / 269,231 *unique reviewers of restaurants* / 92,770 unique reviewers of restaurants in Phoenix / **129,019 unique reviewers of restaurants in Las Vegas**.

Tips:

495,107 tips / 304,388 *restaurant tips* / **141,844 restaurant tips in Las Vegas**.

Check-ins:

45,166 check-ins / 18,640 *restaurant check-ins* / **4,596 restaurant check-ins in Las Vegas**.



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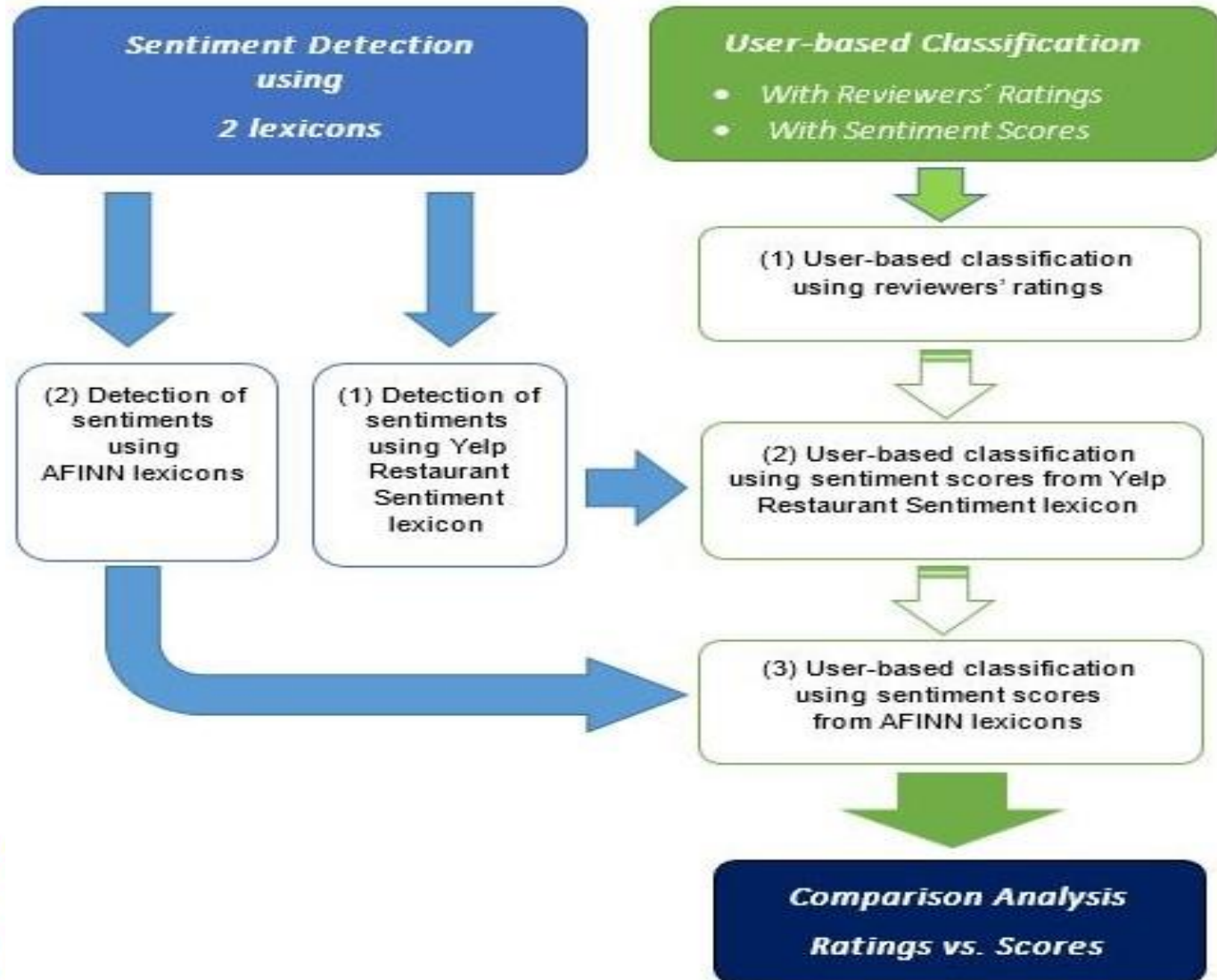
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business_id	name	full_address	city	state	latitude	longitude	price_range	avg_stars	WaiterService
HsAYzU2-Z_vZAaRqHbcP8g	Archi's Thai Kitchen	6360 W Flamingo Rd Las Vegas, NV 89103	Las Vegas	NV	36.1148	-115.231	2	4	TRUE

- **Score = 0 (control variable)**
- **Scaling: good idea, but sampling issues with package**
- **Method to measure the accuracy of the lexicon-based results? (Clueless)**



Confusion Matrix – Top Recommendations (gR = min)

Ratings (evaluationScheme = e6) goodRating = min

	TP	FP	FN	TN	precision	recall	TPR	FPR
1	3.851091e-03	4.337612e-01	7.653402e-01	3.167970e+02	8.752142e-03	2.776628e-03	2.776628e-03	1.366174e-03
3	8.215661e-03	1.304621e+00	7.609756e-01	3.159262e+02	6.247609e-03	5.567485e-03	5.567485e-03	4.109144e-03
5	1.168164e-02	2.176380e+00	7.575096e-01	3.150544e+02	5.310733e-03	8.251324e-03	8.251324e-03	6.855031e-03
10	1.848524e-02	4.357638e+00	7.507060e-01	3.128732e+02	4.208361e-03	1.330497e-02	1.330497e-02	1.372565e-02

AFINN Scores (evaluationScheme = e7) Unscaled, goodRating = min

	TP	FP	FN	TN	precision	recall	TPR	FPR
1	3.080873e-03	4.323492e-01	7.709884e-01	3.167936e+02	7.037144e-03	1.950114e-03	1.950114e-03	1.361741e-03
3	7.958922e-03	1.298331e+00	7.661104e-01	3.159276e+02	6.072647e-03	5.777276e-03	5.777276e-03	4.089359e-03
5	1.193838e-02	2.165212e+00	7.621309e-01	3.150607e+02	5.474954e-03	7.940856e-03	7.940856e-03	6.819804e-03
10	1.951220e-02	4.334788e+00	7.545571e-01	3.128911e+02	4.484101e-03	1.354409e-02	1.354409e-02	1.365351e-02

YelpRRL Scores (evaluationScheme = e5) Unscaled, goodRating = min

	TP	FP	FN	TN	precision	recall	TPR	FPR
1	2.439024e-03	4.397946e-01	7.648267e-01	3.167929e+02	5.450017e-03	1.300874e-03	1.300874e-03	1.385197e-03
3	6.418485e-03	1.320282e+00	7.608472e-01	3.159125e+02	4.831653e-03	4.417000e-03	4.417000e-03	4.158571e-03
5	9.242619e-03	2.201926e+00	7.580231e-01	3.150308e+02	4.185160e-03	6.101143e-03	6.101143e-03	6.935560e-03
10	1.810013e-02	4.404236e+00	7.491656e-01	3.128285e+02	4.080792e-03	1.225643e-02	1.225643e-02	1.387235e-02

Discussion: assumptions too restrictive (analyst + algorithm)




Accuracy – Normalization and Similarity Methods

Ratings (r6_test) 1 to 5 med: 4  avg: 3.9 

	err_rec_e6	err_rec_e6Zc	err_rec_e6Cc	err_rec_e6Zj	err_rec_e6Cj	err_rec_e6Zp	err_rec_e6Cp
RMSE	3.155829	3.16258	3.155829	3.894907	3.894743	0.4002831	0.392053
MSE	9.959257	10.00192	9.959257	15.1703	15.16902	0.1602266	0.1537056
MAE	2.093794	2.094842	2.093794	3.393677	3.391859	0.3411652	0.3455556

AFINN Scores (r7_test) -36 to 221 med: 11 avg: 13.2  

	err_rec_e7	err_rec_e7Zc	err_rec_e7Cc	err_rec_e7Zj	err_rec_e7Cj	err_rec_e7Zp	err_rec_e7Cp
RMSE	19.84632	19.83433	19.84632	19.00564	18.97876	6.788345	6.788345
MSE	393.8765	393.4007	393.8765	361.2145	360.1932	46.08163	46.08163
MAE	14.51682	14.53179	14.51682	14.00251	13.98031	6.714286	6.714286

YelpRRL Scores (r5_test) -234 to 250 med: 12 avg: 13.9  

	err_rec_e5	err_rec_e5Zc	err_rec_e5Cc	err_rec_e5Zj	err_rec_e5Cj	err_rec_e5Zp	err_rec_e5Cp
RMSE	30.80202	30.68852	30.80202	23.75235	23.74753	14.76338	14.81311
MSE	948.7641	941.7852	948.7641	564.174	563.9451	217.9573	219.4283
MAE	22.09031	21.98407	22.09031	16.86814	16.86548	12.04053	12.16659

Discussion: Pearson is best, but slow & scanty (minutes).
Jaccard is effective and efficient across the board (seconds).



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Conclusion

- **Hopes too high for the project**

- CRAB for Python left adrift since 2011: out of date
- recommenderlab for R cannot allow cross-evaluation of models using the same random sample (user-restaurant combinations and different data)

- **recommenderlab still performs well**

- Scaling was not necessary for the delivery of top 5 recommendations and for accuracy evaluations.
- Ratings and sentiment scores produce different recommendations, but we cannot determine which approach produces more accurate and reliable results.

- The **rating-based collaborative approach** remains the **fastest** and the most **economical** based on the project's results.



Any questions?

