Reaching beyond the Stars

in recommending Thai Restaurants in Las Vegas

Presentation Outline

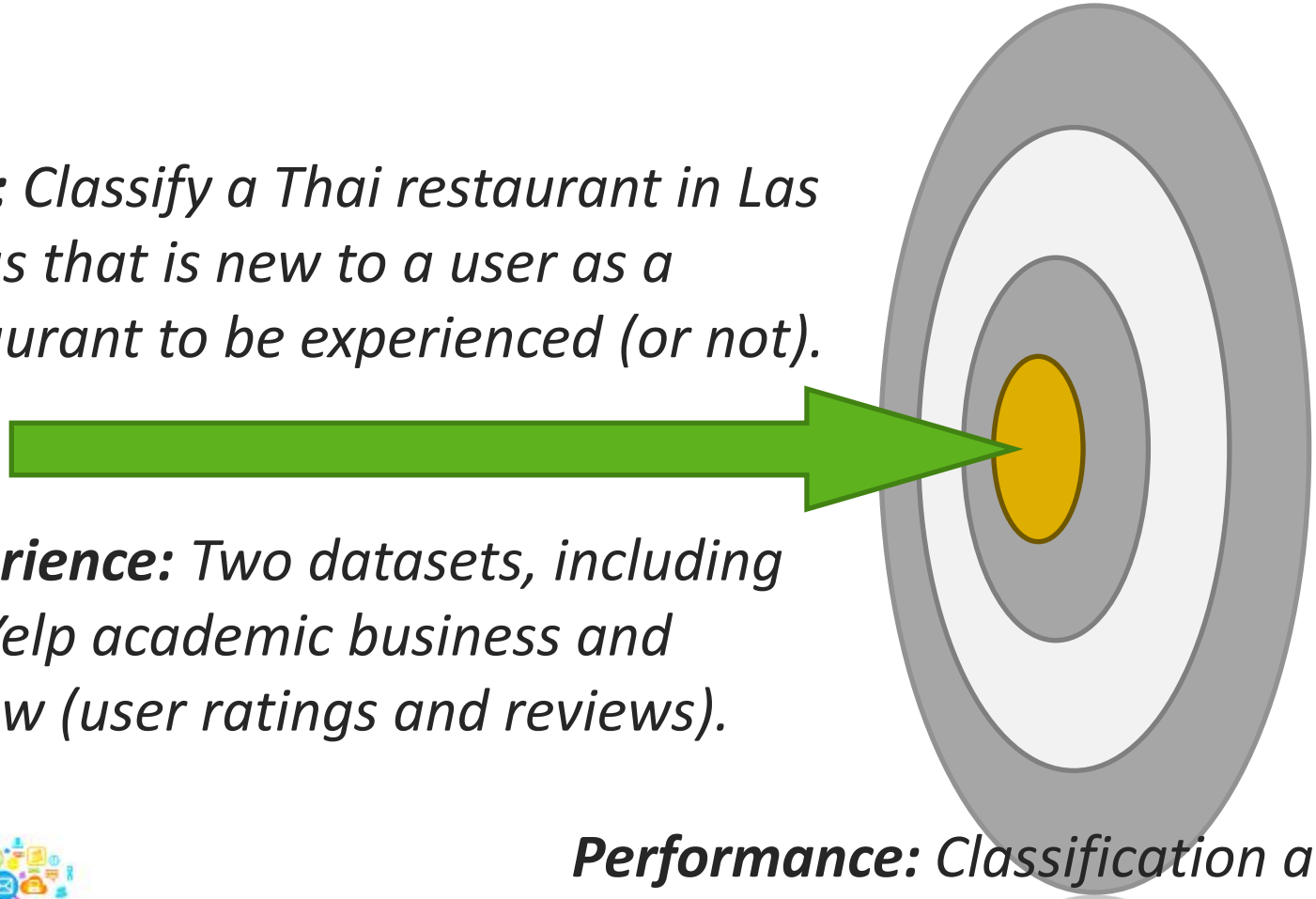
1. Problem Definition
2. Techniques Used in the Literature
3. Dataset Description
4. Methodology
5. Results and Discussion
6. Conclusion

Presentation Outline

1. Problem Definition
2. Techniques Used in the Literature
3. Dataset Description
4. Methodology
5. Results and Discussion
6. Conclusion

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.

Presentation Outline

1. Problem Definition
2. Techniques Used in the Literature
3. Dataset Description
4. Methodology
5. Results and Discussion
6. Conclusion

Techniques Used in the Literature

recommenderlab for R

- *Sampling*
- *Top 5 list (highest Predictions)*
- *Prediction Matrix*
- *RMSE & Confusion Matrix*

RATINGS

Recommender Algorithm

UBCF

Used in ***collaborative recommendation***

Reviews

SENTIMENT Detection & **SCORES**

Lexicon-based Approach

- *Common words and emoticons with sentiment attached*
- *Each element from lexicon detected in text delivers a score which is added to the total.*

Supervised Learning (i.e.: domain specific)
Unsupervised learning (clustering)
Hybrid Approach

Presentation Outline

1. Problem Definition
2. Techniques Used in the Literature
3. Dataset Description
4. Methodology
5. Results and Discussion
6. Conclusion

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.**

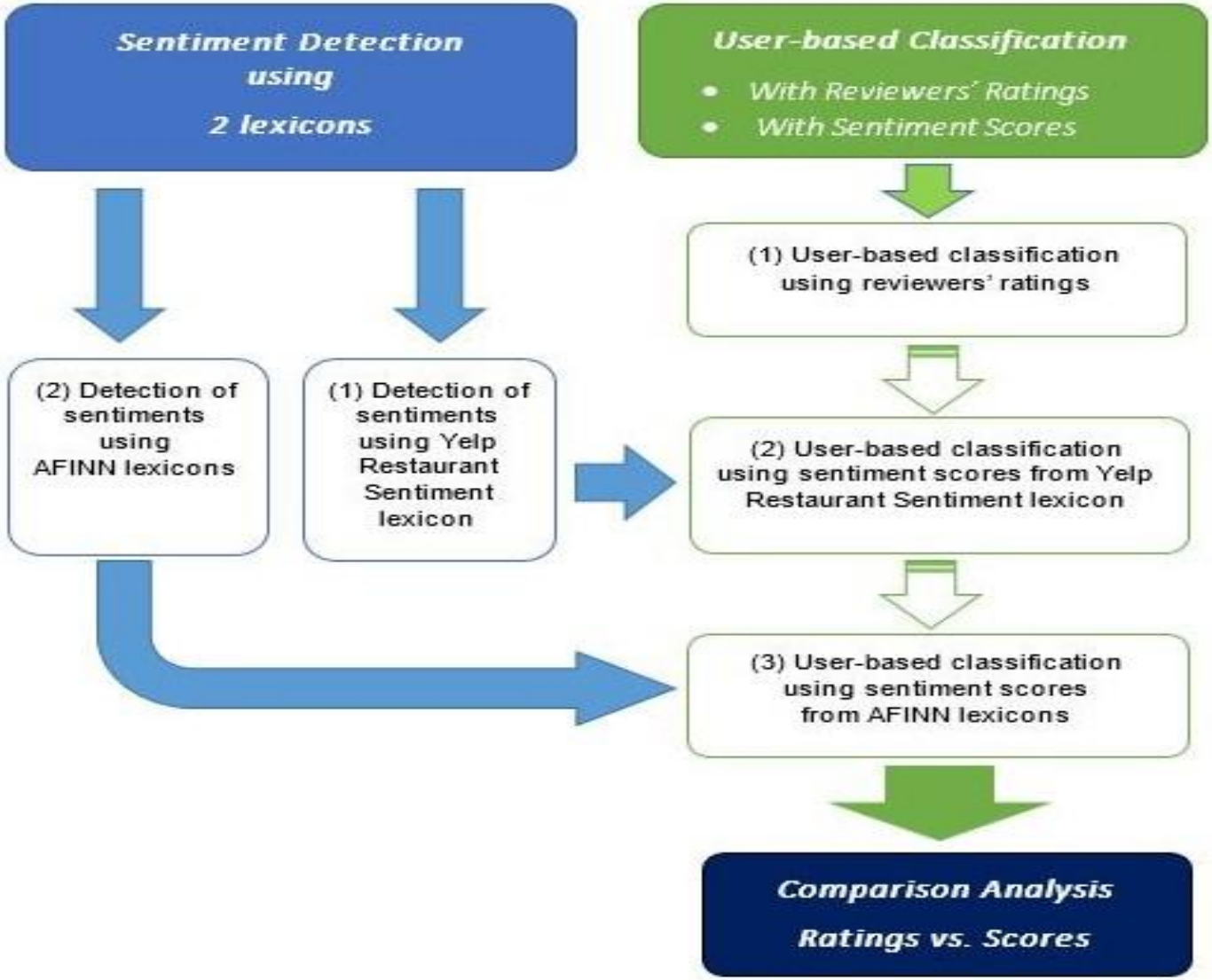
Tips: 495,107 tips / *304,388 restaurant tips* / **141,844 restaurant tips in Las Vegas.**

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

Presentation Outline

1. Problem Definition
2. Techniques Used in the Literature
3. Dataset Description
4. Methodology
5. Results and Discussion
6. Conclusion

Methodology



Presentation Outline

1. Problem Definition
2. Techniques Used in the Literature
3. Dataset Description
4. Methodology
5. Results and Discussion
6. Conclusion

Sentiment Scoring of Restaurant Reviews

user_id	business_id	text	YRsentiment	YRSentScore	YRSentScore2	AFINNSentScore	AFINNSentScore2	review_ratings
ywf8LhV2jCvbksPx6wc7aw	ApUCpJ9aa6yVgsde16gYrg	Closed	0	3	3	0	2	1
aK8shZb9dEQNyxk5ycfO2A	HsAYzU2-Z_vZAaRqHbcP8g	Archi: The Man, the Myth, the Las Vegas Legend.	45.181	3	3.5	16	2	4

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

Discussion:

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

Top 5 for aYzA3OgsAN3f3WJPucYCAQ

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 (evaluationScheme = e6) 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 (evaluationScheme = e7) -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 (evaluationScheme = e5) -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).

Presentation Outline

1. Problem Definition
2. Techniques Used in the Literature
3. Dataset Description
4. Methodology
5. Results and Discussion
6. Conclusion

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 **fast**est and the most **economical** based on the project's results.

Any questions?