Paper ID	20221204
Paper Title	Enhance Rating Prediction for E-commerce Recommender System using Hybridization SDAE, Attention Mechanism and Probabilistic Matrix Factorization

Recommendation for Publication
☐(Evaluation A:) Accept ☐(Evaluation B:) Accept after Minor Revision ☐(Evaluation C:) Accept after Major Revision ☐(Evaluation D:) Reject

Comments from reviewers 1 & 2:

1. "long short term memory (LSTM) and SDAE in 1,6%" -> "long short term memory (LSTM) and SDAE in 1.6%". The authors should distinguish between "." and ",".
2. "GLOVE" -> "GloVe"
3. In the Introduction part, strong points of this proposed method should be further stated and organization of this whole paper is supposed to be provided in the end.
4. To help readers' understanding, please add equation numbers to all equations.
5. The presentation of figures is not professional. In figures, letters are too small. Enlarge or Redraw figures. e.g. see Fig. 3 and 4.
6. The equation of RMSE should be improved. See root.
7. Please provide the reference number of the article compared to the proposed method in section 3.
8. In Figs. 6 and 7, the meaning of each graph is not clear.
9. There is no X-axis label in Figs. 6 and 7.

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1. This is well written and organized paper. It is scientifically sound and contains sufficient interest to merit publication.
2. To help readers' understanding, the authors should add a notation list, because there are many variables in equations. Besides, the meaning of some functions are variables is not clear. The authors describes the notation of equations. However, it's not enough.
3. Which articles did you compare with the proposed technique? Indicate the reference number in sentences. Besides, the authors must cite the compared articles in References. The reviewer fails to understand the relationship between the compared techniques and the research survey.
4. The results of this research are not clear in Conclusions. Show the scientific contribution of this work with concrete data.

From Editor:
Please space one line around equations.

Please improve the reference format. This is very important for indexing service. If you did not follow the following format, your paper will be rejected automatically.

*Do not use "et al." in author names.

e.g.

[1] R. Ruskone, S. Airault, and O. Jamet, "Vehicle Detection on Aerial Images", International Journal of Intelligent Engineering and Systems, Vol.1, No.1, pp.123-456, 2009.

(In the case of Journal Papers)

[2] R. Ruskone, L. Guigues, S. Airault, and O. Jamet, "Vehicle Detection on Aerial Images", In: Proc. of International Conf. On Pattern Recognition, Vienna, Austria, pp.900-904, 1996.

(In the case of Conference Proceedings)

*Note: e.g. In the case of the author name:"John Doe", express as "J. Doe". ("John" is the first name and "Doe" is the family name.)

* * Please send your revised manuscript with the response letter for the 2nd review. (Please highlight modifications and additions inside the paper by red font.)

Please add "Conflicts of Interest" and "Author Contributions". (see the IJIES format.docx)

Conflicts of Interest (Mandatory)

Declare conflicts of interest or state "The authors declare no conflict of interest." Authors must identify and declare any personal circumstances or interest that may be perceived as inappropriately influencing the representation or interpretation of reported research results.

Author Contributions (Mandatory)

For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used as follows: "conceptualization, XXX and YYY; methodology, XXX; software, XXX; validation, XXX, YYY, and ZZZ; formal analysis, XXX; investigation, XXX; resources, XXX; data curation, XXX; writing—original draft preparation, XXX; writing—review and editing, XXX; visualization, XXX; supervision, XXX; project administration, XXX; funding acquisition, YYY", etc. Authorship must be limited to those who have contributed substantially to the work reported.

Evaluation of Paper		
Contents	**Innovation**	□Highly Innovate □Sufficiently Innovate □Slightly Innovate □Not Novel
	Integrality	□Poor □Fair □Good □Outstanding
	Presentation	□Totally Accessible □Mostly Accessible □Partially Accessible □Inaccessible
	Technical depth	□Superficial □Suitable for the non-specialist □Appropriate for the generally knowledgeable individual working in the field □Suitable only for an expert
Presentation &		□Satisfactory □Needs improvement □Poor

Intelligent Networks and Systems Society

Review Form

English	
Overall organization	□Satisfactory □Could be improved □Poor

(IJIES Journal) Reply form:

Dear Respected reviewers, We appreciate your useful comments and kind guidance. We will answer your questions below.

Reviewers' comments to the authors:
1. "long short term memory (LSTM) and SDAE in 1,6%" -> "long short term memory (LSTM) and SDAE in 1.6%". The authors should distinguish between "." and ",".

Answer:
Dear reviewer, thank you for show me the mistake and I have refine some value "," with correct value with ".". Some of them on the table below, and another one in the abstract.

Ratio (%)	Hybrid Collaborative Filtering Model			
	PMF [13]	PHD-PMF [19]	DDL-PMF [20]	SDAE-LSTM-PMF
10%	1.27539	1.17821	1.32981	1.37942
20%	1.05233	0.83530	0.90216	0.90068
30%	0.96513	0.81901	0.80812	0.798412
40%	0.91827	0.80651	0.79945	0.785681
50%	0.88834	0.79962	0.78819	0.779172
60%	0.86673	0.79220	0.78134	0.770198
70%	0.85071	0.78252	0.77681	0.764091
80%	0.84055	0.77991	0.76145	0.755189
90%	0.82796	0.76186	0.75998	0.749038
$\sum$		7.55283	7.70731	7.681881
$\overline{X}$		0.83920	0.85636	0.853542
Improvement in 2.5% vs DDL-PMF, 8% vs PMF in average.				

Reviewers' comments to the authors:
2. "GLOVE" -> "GloVe"

Answer:
Thank you for valuable comment, I have refined the mistake tried to improve GLOVE with GloVe in whole manuscript passage due to GloVe is the correct term of writing. Thank you

Reviewers' comments to the authors:
3. In the Introduction part, strong points of this proposed method should be further stated and organization of this whole paper is supposed to be provided in the end.

Answer:

Reviewers' comments to the authors:
4. To help readers' understanding, please add equation numbers to all equations.

Answer:
Thank you for valuable comment. I have added equation number in each equation from 1-16. The example equation and number mentioned below:

$$p(R|U,V,\sigma^2) = \prod_{i-1}^{N}\prod_{j-1}^{M} N\left[(R_{ij}|U_i^T V_j, \sigma^2)\right]^{I_{ij}}$$

(1)

$$p(U|\sigma_U^2) = \prod_{i=1}^{N} N(U_i|0, \sigma_U^2 I)$$

(2)

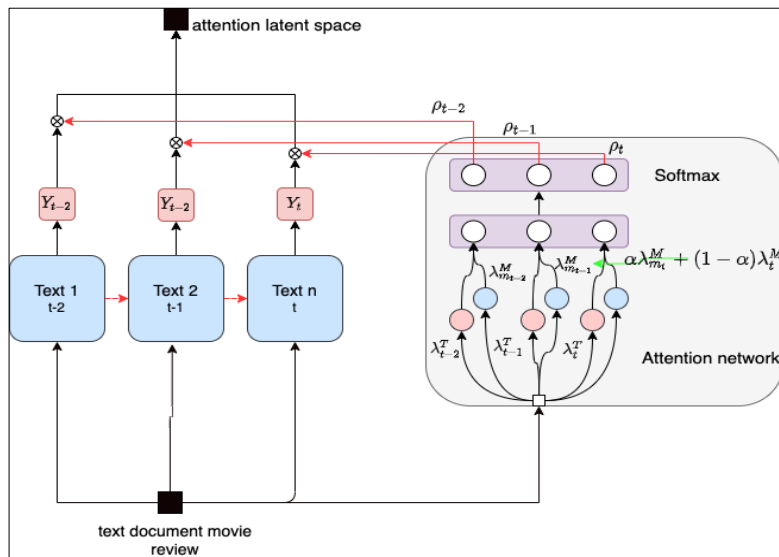$$p(V|\sigma_V^2) = \prod_{j=1}^{N} N(V_j|0, \sigma_V^2 I)$$
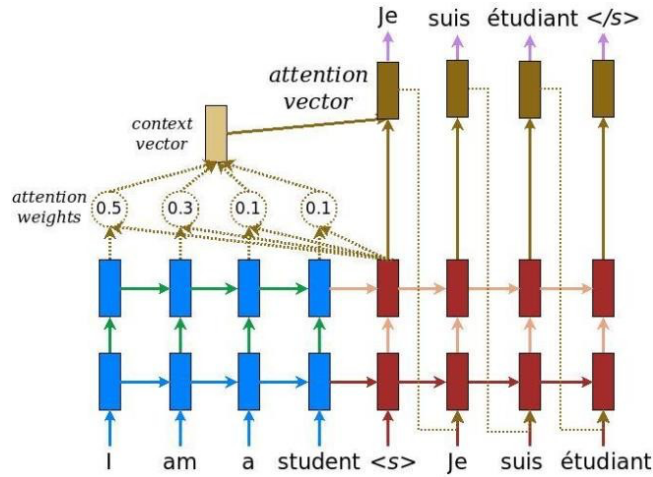
(3)

Reviewers' comments to the authors:
5. The presentation of figures is not professional. In figures, letters are too small. Enlarge or Redraw figures. e.g. see Fig. 3 and 4.

Answer:
Thank you for valuable comment. I have modified the small figure with enlarge the figure that mentioned above.

Reviewers' comments to the authors:
6. The equation of RMSE should be improved. See root.

Answer:
Thank you for valuable comment and suggestion. I have corrected the mistake in RMSE equation such below.

$$RMSE = \sqrt{\frac{1}{N}\sum_{i,j} Z_{i,j}^{P}(R_{ij} - \hat{R}_{ij})^2}$$

Reviewers' comments to the authors:
7. Please provide the reference number of the article compared to the proposed method in section 3.

Answer:
Thank you for valuable comment and suggestion. I have already add the reference number in the manuscript and table comparion.

In the manuscript version:

This experiment scenario aims to observe the effectiveness of the model with attention mechanism to capture product document context from review, where document context with W expect to increase share weigh of product document representation. Finally, according to experiment report on Table 4, the propose model outperform over previous work that involve CNN [15] and LSTM model in capturing of document context [18]. While, according to user information representation in PHD [19] and DDL-PMF [20], they used similar algorithm based on SDAE. In the other hand, it can be concluded that role of Attention mechanism very important to increase share weight W in product document representation. ML.1M MovieLens categorical sparse datasets where the number of rating only 1.41%. However, the performance of SDAE, Attention and PMF achieved better performance over best previous work using PMF [13] and SDAE-LSTM-PMF [20].

In the Table version:

Table 3

Ratio (%)	Hybrid Collaborative Filtering Model			
	PMF [13]	PHD-PMF [19]	DDL-PMF [20]	SDAE-ATT-PMF
10%	1.64697	0.98684	0.96298	0.94787
20%	1.26577	0.94889	0.93392	0.91881
30%	1.11180	0.93053	0.90986	0.89475
40%	1.03992	0.91326	0.89842	0.88331
50%	0.99064	0.89819	0.89371	0.87859
60%	0.95897	0.88936	0.88095	0.86584
70%	0.93369	0.88146	0.87272	0.85761
80%	0.91134	0.87237	0.86605	0.85139
90%	0.90452	0.86919	0.85837	0.84315
$\sum$	9.76335	8.19009	8.07698	7.94132
$\overline{X}$	1.08481	0.91001	0.89744	0.88236
improvement 1.6% vs DDL-PMF, 3% vs PHD, 18% over PMF in average.				

Table 4

Ratio (%)	Hybrid Collaborative Filtering Model			
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Reviewers' comments to the authors:
8. In Figs. 6 and 7, the meaning of each graph is not clear.

Answer:

Reviewers' comments to the authors:
9. There is no X-axis label in Figs. 6 and 7.

Answer:
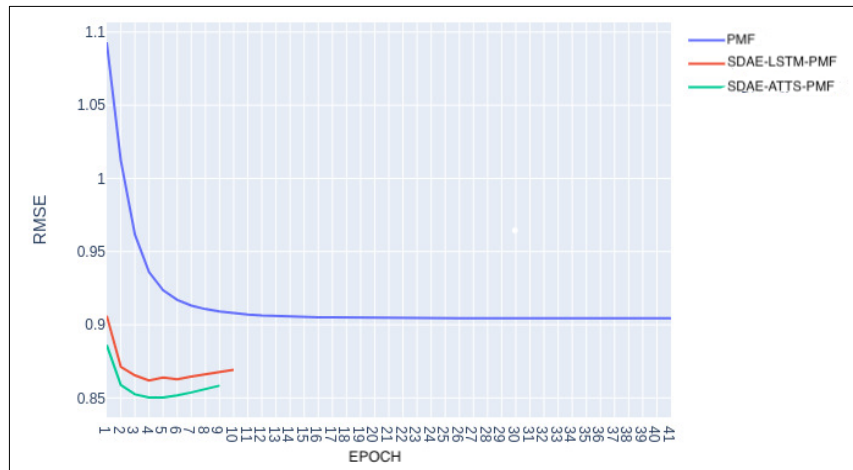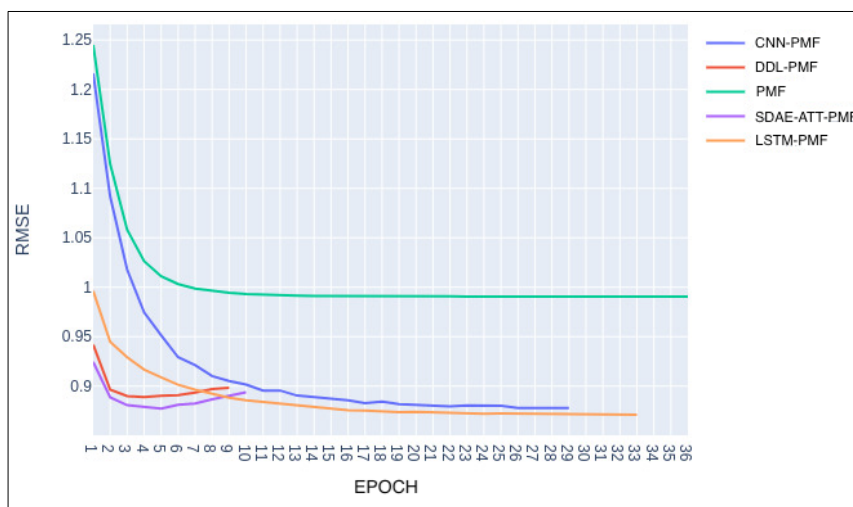I have put X-axis label as number of epoch on Figure 6 and 7.

Figure 6

Figure 7

Reviewers' comments to the authors:
1. This is well written and organized paper. It is scientifically sound and contains sufficient interest to merit publication.

Answer:

Reviewers' comments to the authors:
2. To help readers' understanding, the authors should add a notation list, because there are many variables in equations. Besides, the meaning of some functions are variables is not clear. The authors describe the notation of equations. However, it's not enough.

Answer:

notation	description
U	raw of user information representation
V	raw of item information representation
σ^2	variance value (in this research can be form of the user or item representation)
ε_i	epsilon variable of the item

σ_U^2	variance value of user information representation in the term of demographic information or tags # information
σ_V^2	variance value of item representation in the term of product document
W^+	internal weight from product document representation
σ_V^2	variance value of the item
R_{ij}	actual value of rating
M	Matrix of item representation from MovieLens datasets
N	Matrix of users representation from MovieLens datasets
I_i	diagonal matrix
I_{ij}	indicator function of the matrix
μ	mean value
v_j	product of item j
σ	standard deviation
R	symbol of actual rating matrix
R'	The result of rating matrix prediction from PMF
X	user auxiliary information in the term of demographic information of the user
Y	item extra information in the term of product document information

Reviewers' comments to the authors:

3. Which articles did you compare with the proposed technique? Indicate the reference number in sentences. Besides, the authors must cite the compared articles in References. The reviewer fails to understand the relationship between the compared techniques and the research survey.

Answer:

Thank you for the valuable comment. I have put related reference in the mancuscript and also in the table of comparion. I hope it will increase understanding to reader about my finding in this research. The detail additional explanation and table reference can be seen on below.

This experiment scenario aims to observe the effectiveness of the model with attention mechanism to capture product document context from review, where document context with W expect to increase share weigh of product document representation. Finally, according to experiment report on Table 4, the proposed model outperforms over previous work that involve CNN [15] and LSTM model in capturing of document context [18]. While, according to user information representation in PHD [19] and DDL-PMF [20], they used similar algorithm based on SDAE. In the other hand, it can be concluded that role of Attention mechanism very important to increase share weight W in product document representation. ML.1M MovieLens categorical sparse datasets where the number of ratings only 1.41%. However, the performance of SDAE, Attention and PMF achieved better performance over best previous work using PMF [13] and SDAE-LSTM-PMF [20].

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Improvement in 2.5% vs DDL-PMF, 8% vs PMF in average.				

Reviewers' comments to the authors:

4. The results of this research are not clear in Conclusions. Show the scientific contribution of this work with concrete data.

Answer:

Thank you for the valuable comment. I have add some passage explanation on the manuscript including real data achievement of the model and result of comparison over previous work such as PMF, CNN+PMF, LSTM+PMF, SDAE+CNN+PMF, and SDAE+LSTM+PMF. The detail additional explanation show on below.

In this study, Author adopts attention mechanism to enhance collaborative filtering based by enhancement product document information. Attention mechanism responsible to enhance product document representation in previous work that majority model applied CNN and LSTM. Attention mechanism consider implementing seq2seq aspect. In the other hand, seq2seq aspect responsible to enhance product document understanding in the contextual point of view to support PMF in generating rating prediction.

The attention mechanism model that combined with SDAE and PMF applied in ML.1M. According to the experiment report and comparison, attention mechanism succeed to generate rating prediction with tremendous result. Attention achieved better performance in 1.6% in average over DDL-PMF, 3% in average over PHD-MF, and 8% in average over traditional PMF. The impact of involvement product document enhancement using attention mechanism play important role in effectiveness of this model.

The second experiment demonstrated the involvement of attention mechanism suitable to adopt in huge datasets (ML.10M) that contain 10 Millions rating and success to increase effectiveness of rating prediction 2.5% in average over previous best perform using DDL-PMF, and achieved 8% in average over PMF model. Moreover, attention mechanism model also achieves in low repetition to achieve training convergence. Author believes that enhancement of item document representation based on attention and user information representation become essential factor in performance result.

From Editor:
Please space one line around equations.

Author comment:
Thank you for the advice, the one line space was added in every equation from equation 1 to 16.

From Editor:
Please improve the reference format. This is very important for indexing service. If you did not follow the following format, your paper will be rejected automatically.

Author comment:
I have tried to refine reference format according to the suggestion above and Ijies rule. Thank you.

From Editor:
Do not use "et al." in author names.

Author comment:
I found the reference with et al that made automatically by reference tools. I have already improved the mistake according to suggestion above such as reference below.

Hanafi, E. Pujastuti, A. Laksito, R. Hardi, R. Perwira, A. Arfriandi, Asroni, "Handling Sparse Rating Matrix for E-commerce Recommender System Using Hybrid Deep Learning Based on LSTM, SDAE and Latent Factor," International Journal of Intelligent Engineering and Systems, vol. 15, no. 2, pp. 379–393, 2022, doi: 10.22266/ijies2022.0430.35.

From Editor:
Please add "Conflicts of Interest" and "Author Contributions". (See the IJIES format.docx)

It work by myself, so whole research contribution belong to me. I have no put author contribution following to single author rule normaly.