

TrNews: Heterogeneous User-Interest Transfer Learning for News Recommendation

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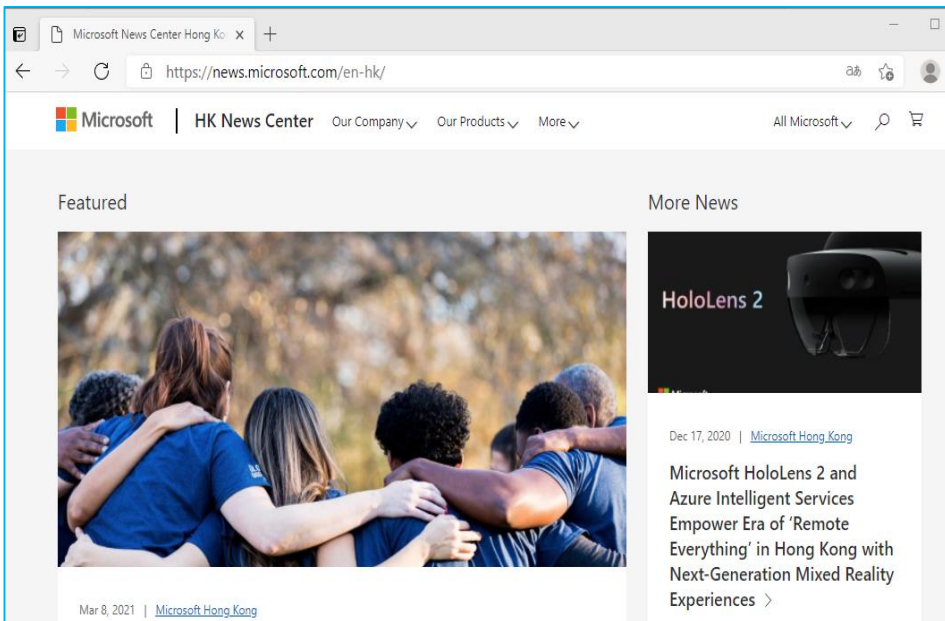
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News feeds online platforms

Microsoft news

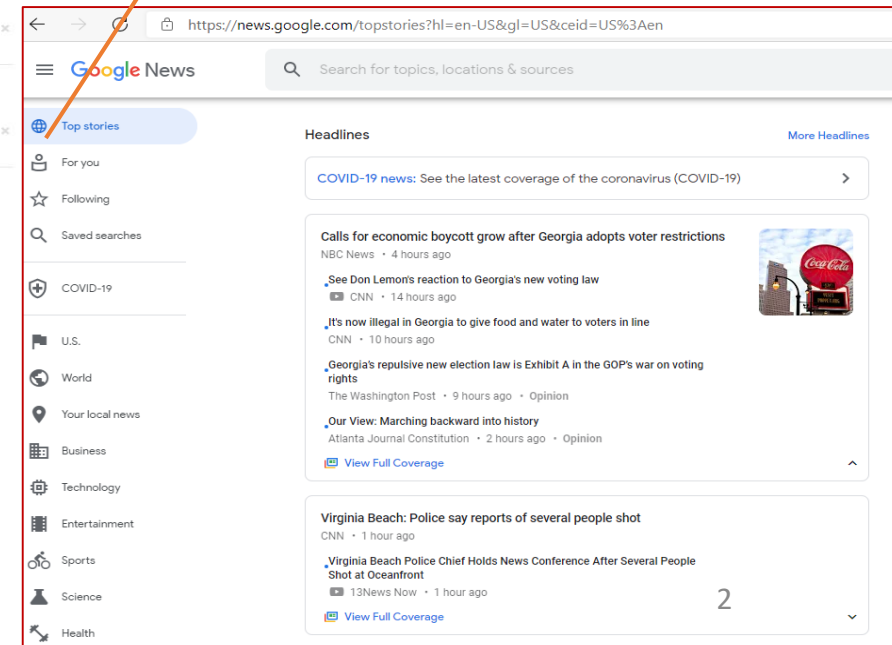


Toutiao

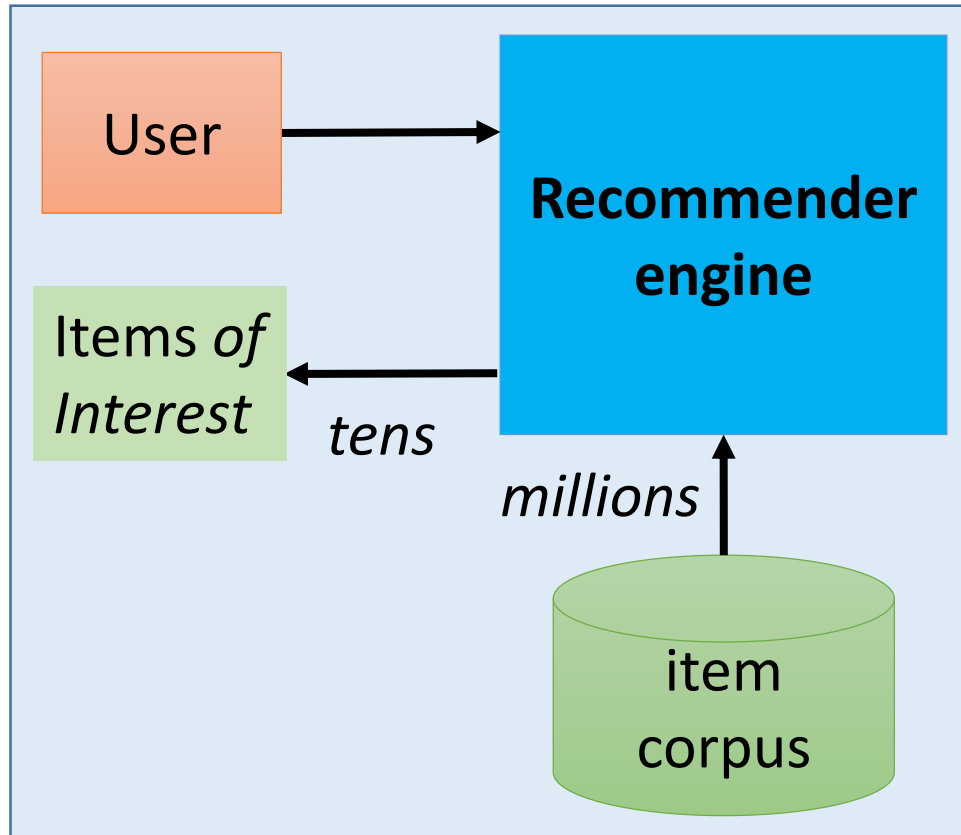
retrieved on March 27

personalized modules on platforms

Google news

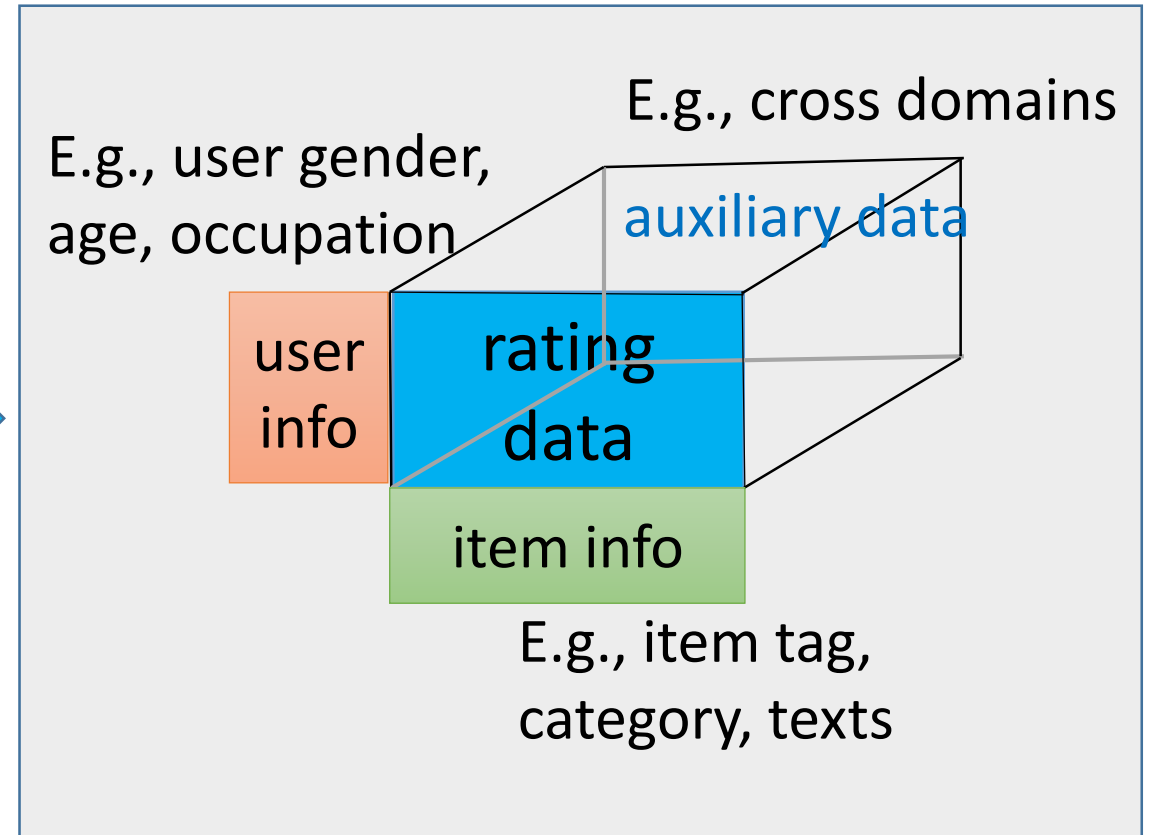


Recommender systems: engine & sources



Recommender engine

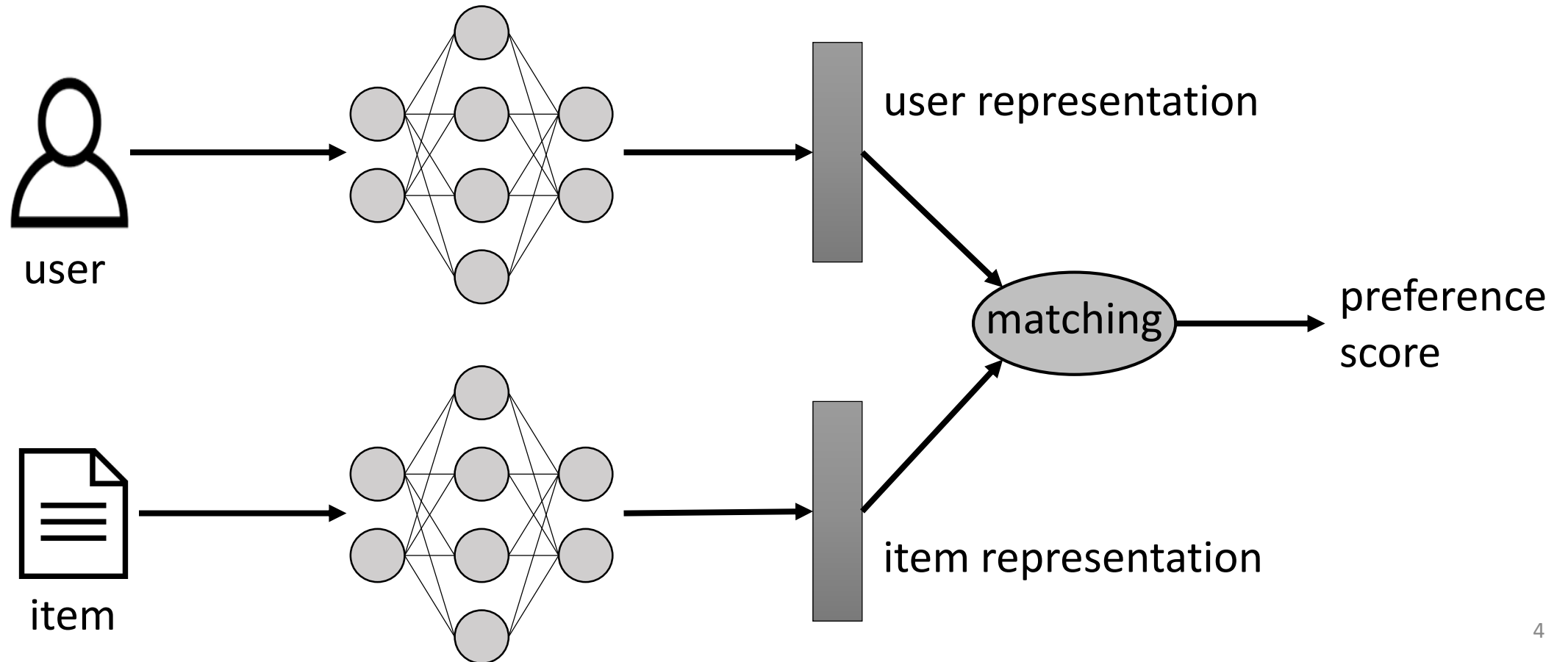
learn from



Data sources

Deep learning meets recommender systems

- Learning user and item representations (recsys) by representation learning (deep learning)



Deep learning with small data



Extensive rating data in **English domain**

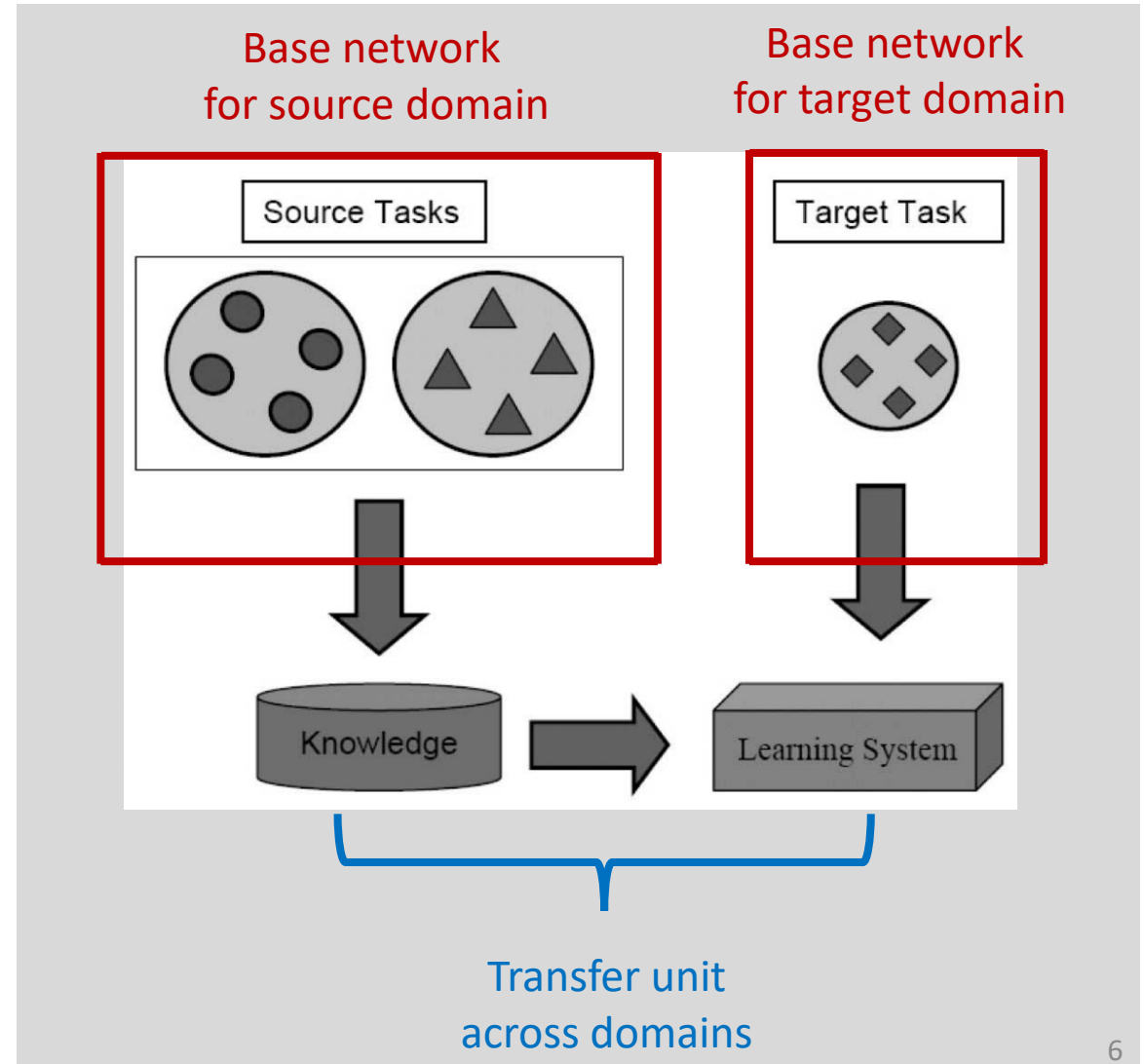
knowledge
transfer



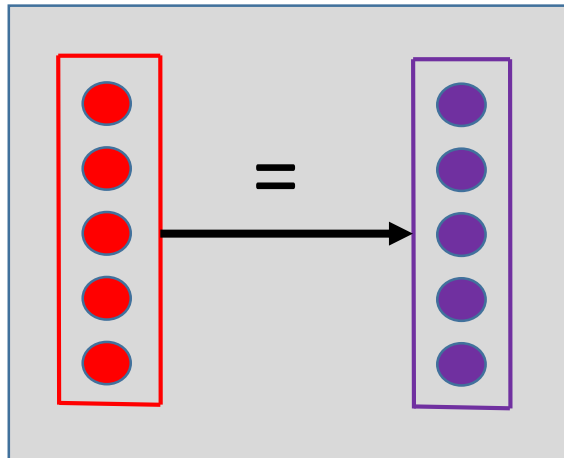
Limited rating data in **Chinese domain**

Deep knowledge transfer

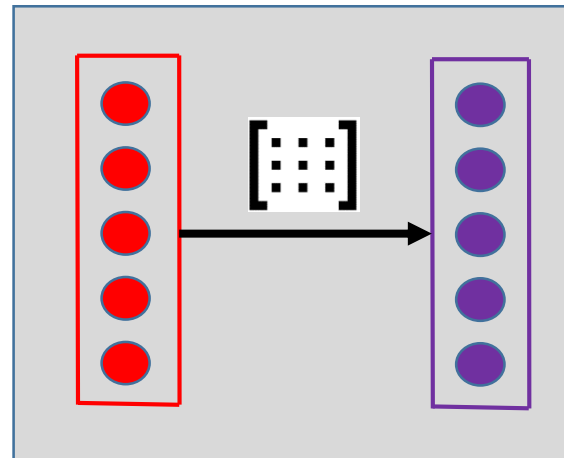
- **Base network**
 - Answering how to model the individual domain
- **Transfer unit**
 - Answering “what to transfer” across domains
- **Joint learning**
 - Training base networks and transfer unit in end-to-end way



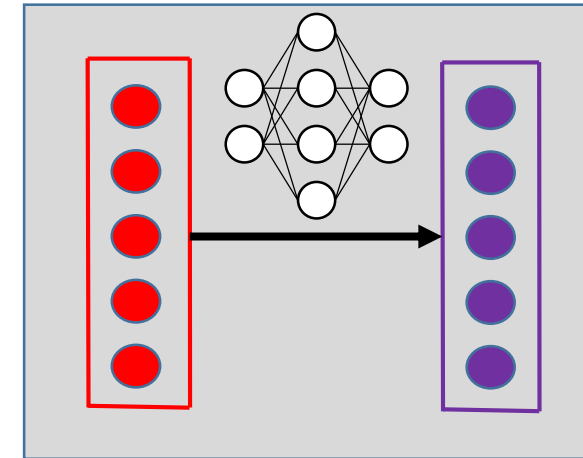
Feature representation transfer: strategies



Identity transfer: No adaptation
(Pan et al, AAAI'10)
pre-trained features: No fine-tuning



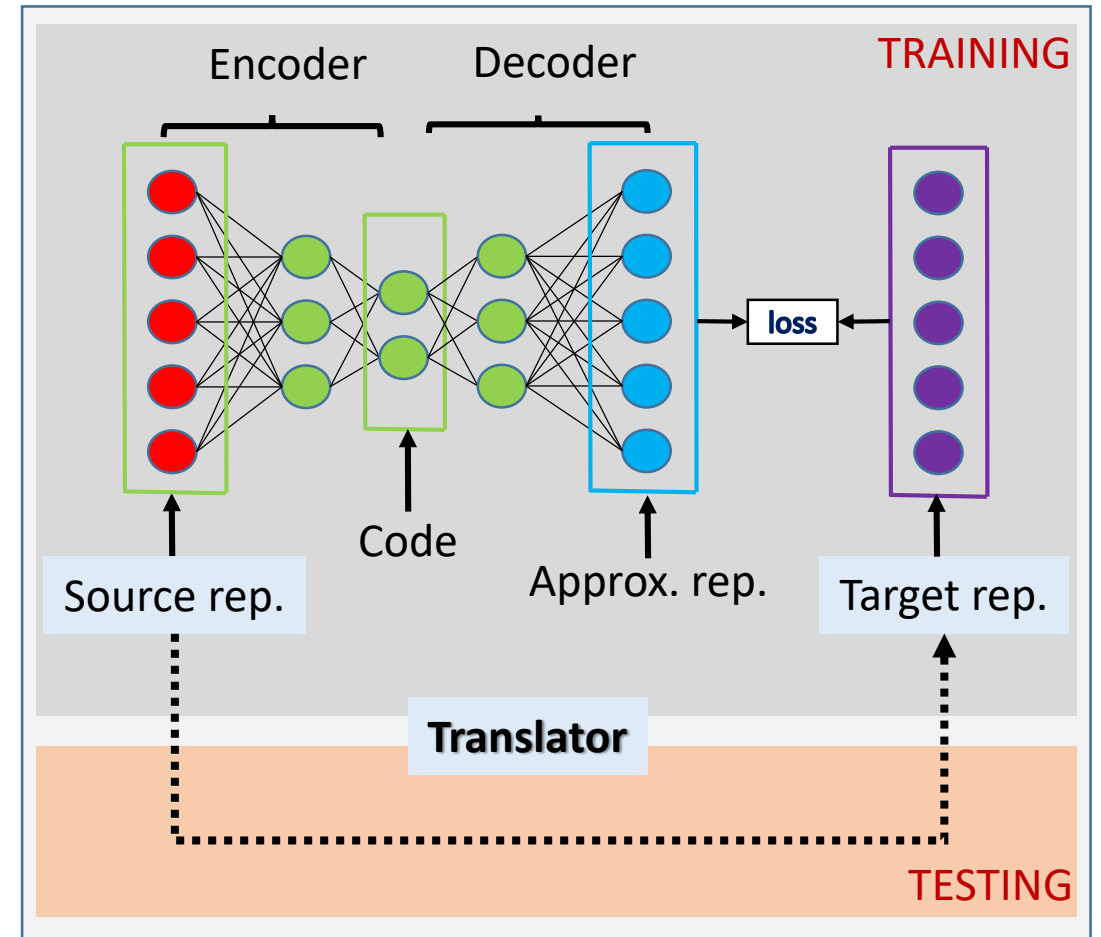
Linear transfer
(Liu et al, AAAI'18; Li & Tuzhilin, WSDM'20)



Nonlinear transfer: Dilated MLP
(Man et al, IJCAI'17)

Proposed TrNews

- The key: Translator
- Translator: mapping user reps from source to target domain
 - attack heterogeneous feature space
- Translator: bottleneck architecture
 - deep layers
 - reduce overfitting risks
 - compress feature representations



Methodology

- Training phase: learn translator

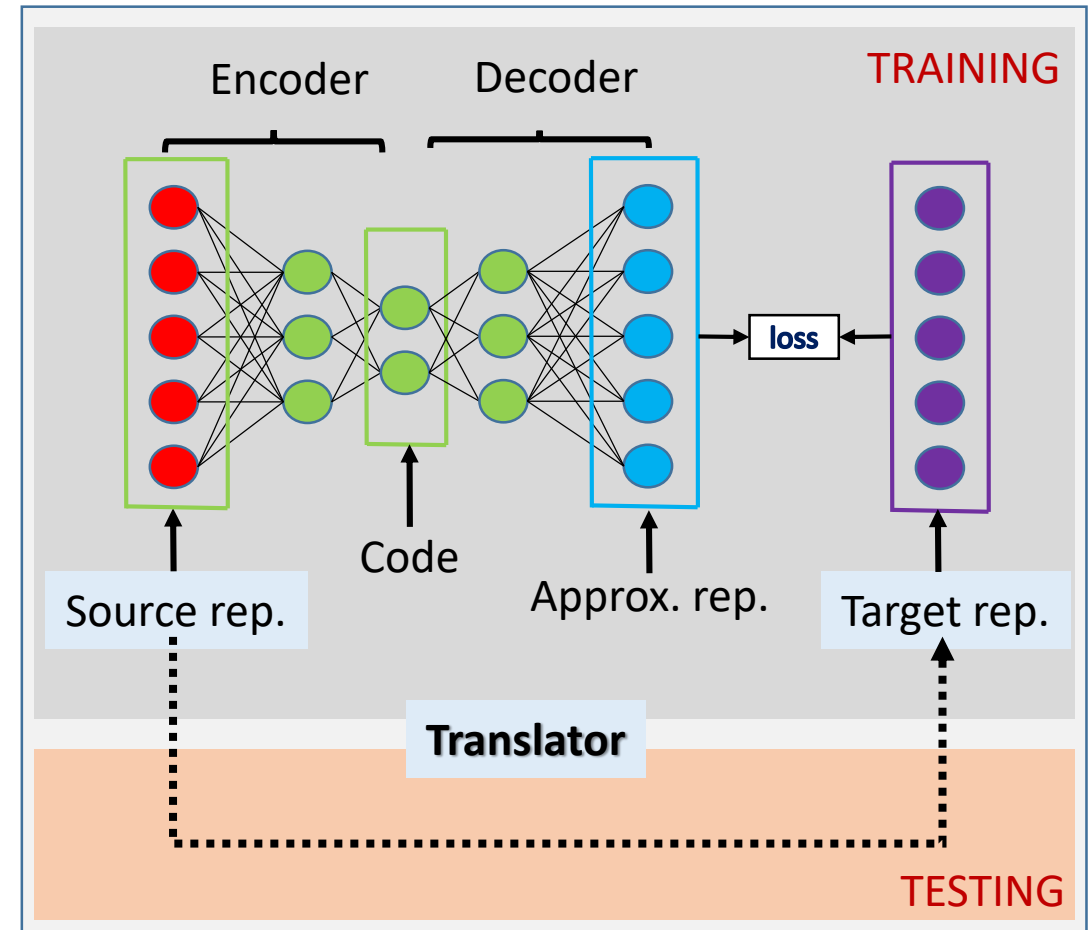
Step 1: mapping $\tilde{\phi}_S(u) = \text{De}(\text{En}(\phi_S(u)))$

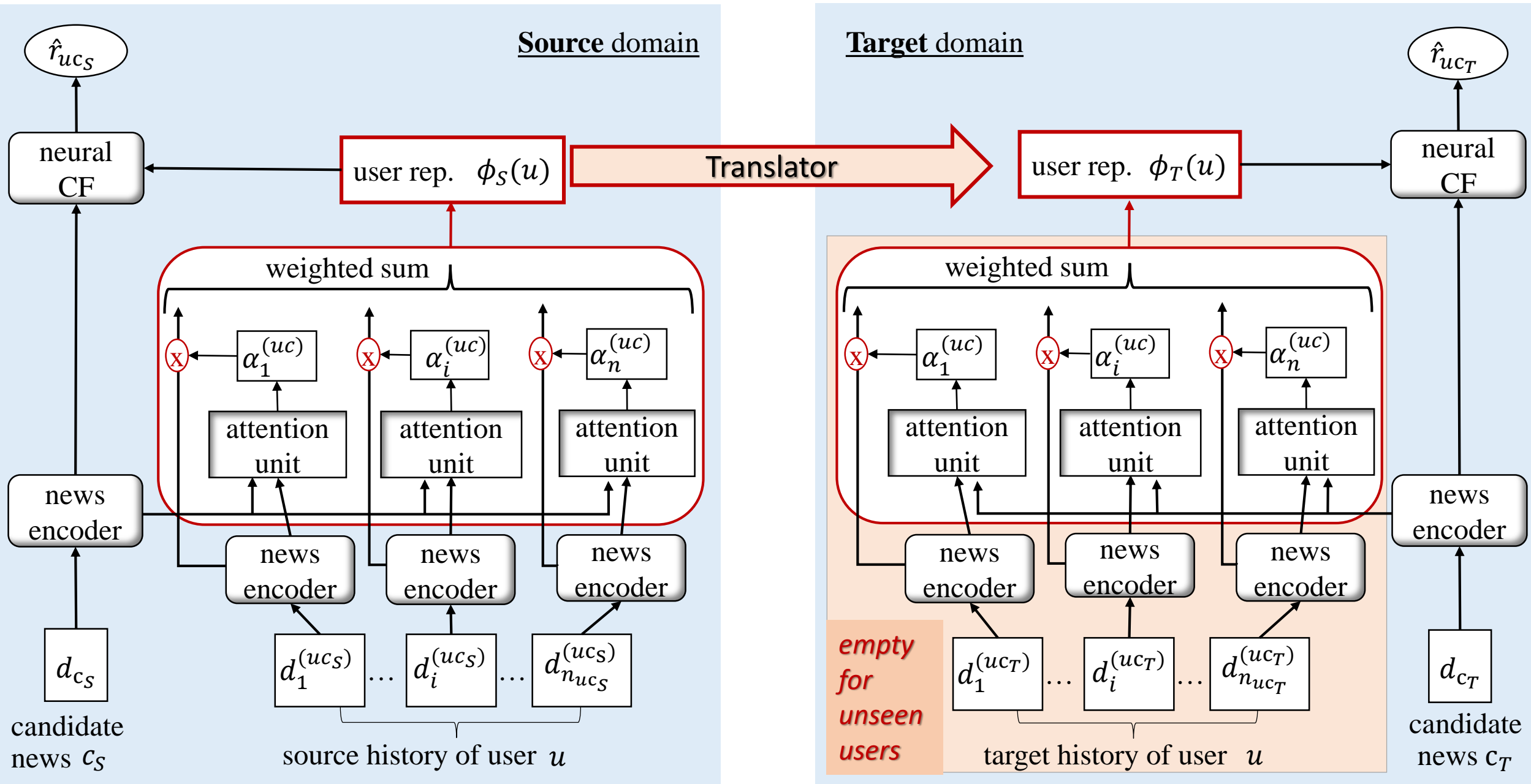
Step 2: supervised loss $\|\phi_T(u) - \tilde{\phi}_S(u)\|_F^2$

- Inference phase: use translator

$$\phi_T(u^*) \triangleq \text{De}(\text{En}(\phi_S(u^*)))$$

where u^* is cold start user in target domain





Datasets

- Cheetah Mobile (geolocations: New York, Florida, Texas, California)
 - News reading logs of users collected in January of 2017 with
 - Top two categories (political & daily) used as the cross corpora
 - mean length of news articles = 12 words
 - mean length of user history = 45 articles
- Microsoft MIND (small version)
 - The clicked historical news articles are positive examples
 - Top two categories (news & sports) of news used as the cross corpora
 - mean length of news articles = 40 words
 - mean length of user history = 13 articles

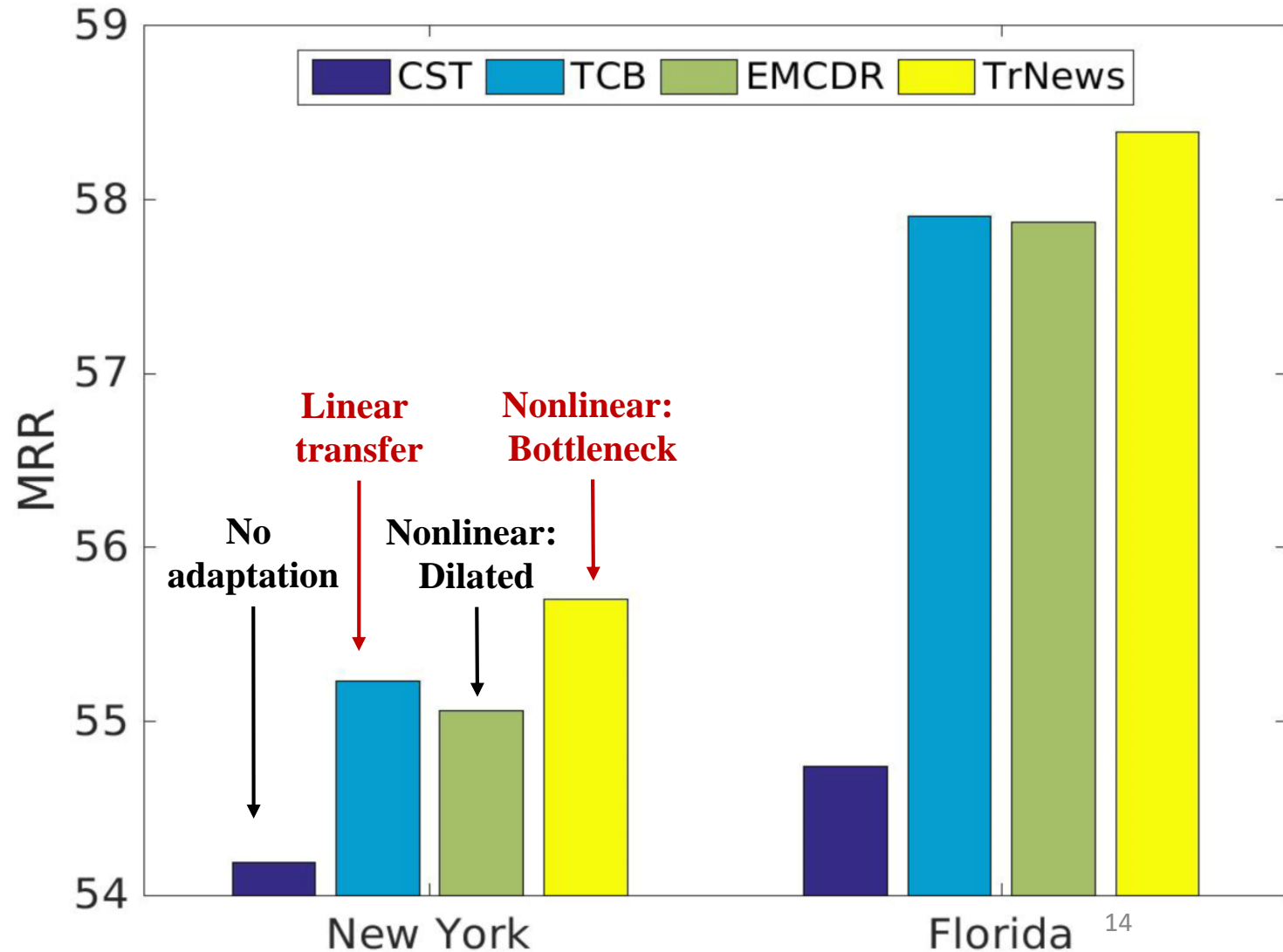
Experiments with SOTA baselines

- POP is competitive
- Neural methods are better than shallow LR (logistic regression)
- TrNews is the best with large improvement

MIND	HR@5	HR@10	NDCG@5	NDCG@10	MRR	AUC
POP	84.18	92.80	69.61	72.43	66.33	95.13
LR	92.69*	96.66*	85.81	87.11*	84.33*	97.92*
TANR	89.94	95.34	89.94*	83.38	79.84	97.86
DeepFM	89.16	94.78	79.36	81.19	77.12	97.63
DIN	89.28	94.88	80.16	82.03	78.22	97.63
TrNews	97.36	99.02	94.16	94.74	93.45	99.47

Experiments with transfer baselines

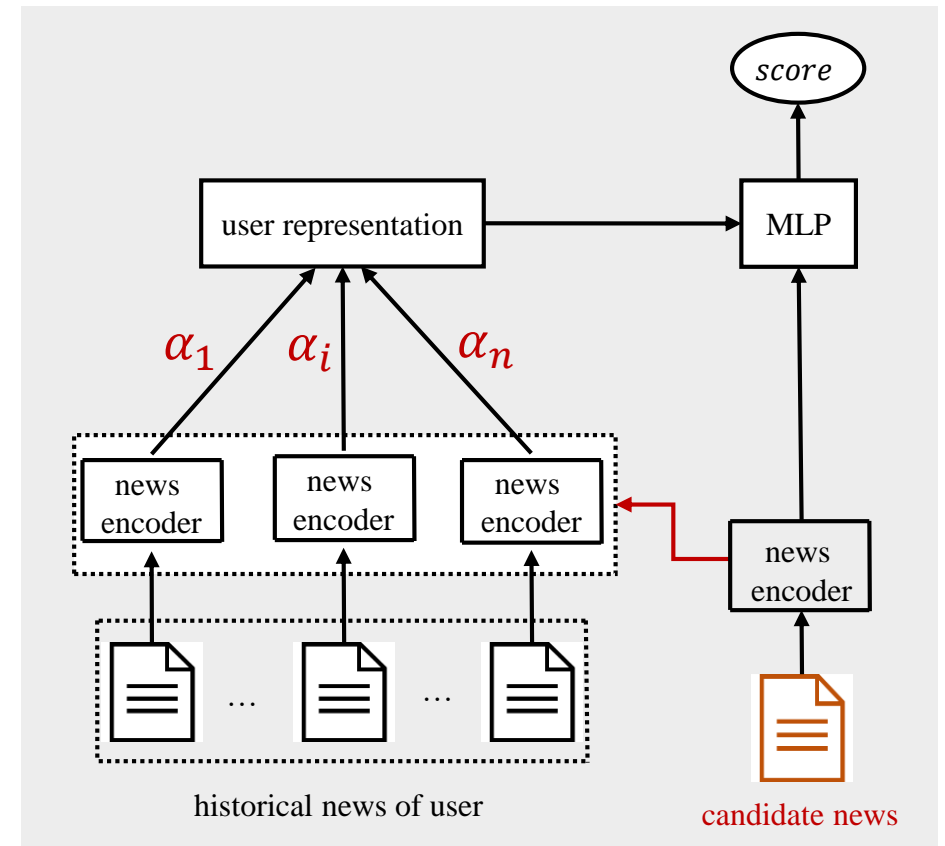
- Adaptation is better than No adaptation
- Nonlinear transfer may worse than linear transfer
- Bottleneck architecture is superior than dilated one



Visualization & explanation

- *Short-term* user interests: latest three matter the most
- *Long-term* user interests: oldest two still impact
- Filter out *irrelevant* articles from history

Historical news	Attn. weight
hillary clinton makes a low-key return to washington	0.04
the hidden message in obama's 'farewell' speech	0.12*
here's why sasha obama skipped the farewell address	0.00
donald trump's 'prostitute scandal' was filmed by cameras and recorded with microphones hidden behind the walls	0.00
white house official explains sasha obama's absence at father's farewell speech	0.00
irish bookie puts odds on trump's administration, inauguration and impeachment	0.00
heads are finally beginning to roll at the clinton foundation	0.00
donald trump's incoming administration considering white house without press corps	0.76
donald trump says merkel made 'big mistake' on migrants	0.05
controversial clinton global initiative closing its doors for good	0.00
army chief gen. bipin rawat talks about equal responsibility for women in the frontlines. we couldn't agree more	N/A



Thanks!

Q & A