

# Task Recommendation in Crowdsourcing

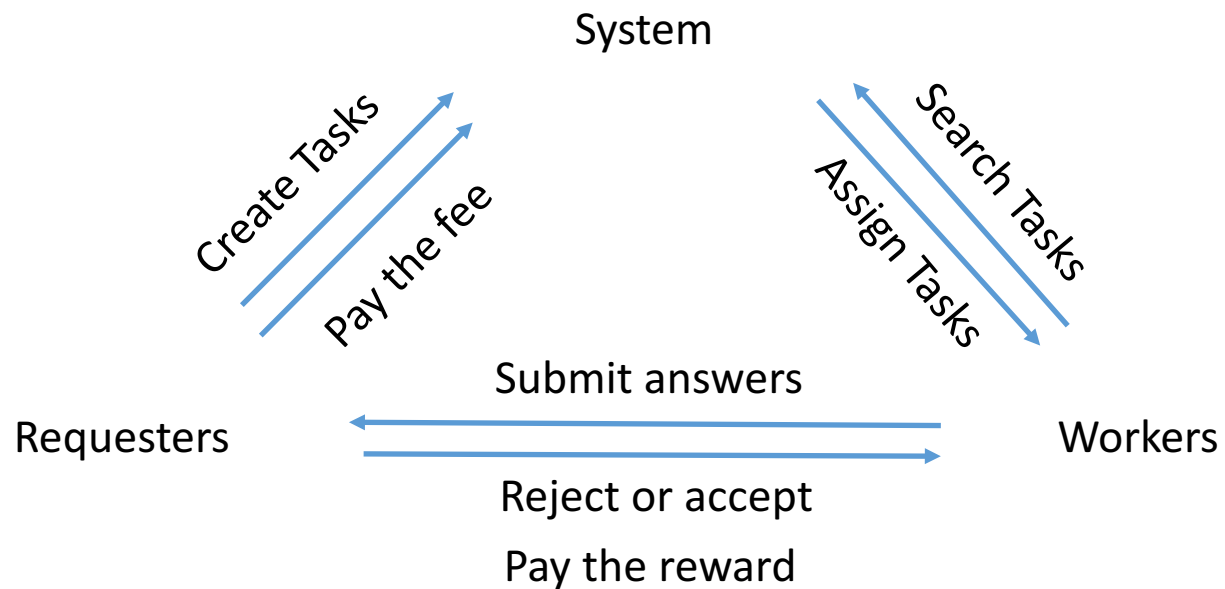
You Ming Hsu

2018.10.16

# Outline

- Purpose
- Crowdsourcing Recommendation Papers
- Conclusion and Future work
- References

# Crowdsourcing Workflow



# Amazon Mechanical Turk

Worker ID: A1PAVCTFXQATXL 

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**HITs**

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## HIT Groups (1-20 of 691)



Show Details



Hide Details

Items Per Page:

20



Requester	Title	HITs	Reward	Created	Actions	
<a href="#">Ibotta Turk</a>	Are these receipts the same?	1	\$0.01	23s ago	<a href="#">Preview</a>	<a href="#">Qualify</a>
<a href="#">amturk</a>	Input specific values displayed in the image.	1	\$0.02	26s ago	<a href="#">Preview</a>	<a href="#">Qualify</a>
<a href="#">411Richmond</a>	Verify a single value from a receipt	3	\$0.01	20s ago	<a href="#">Preview</a>	<a href="#">Accept &amp; Work</a>
<a href="#">Job Spotter</a>	Collect store information of a hiring sign (WARNING: This HIT may contain adult c...	3	\$0.06	27s ago	<a href="#">Preview</a>	<a href="#">Qualify</a>
<a href="#">Studio71 Tech</a>	VIDEO - Identify potentially offensive videos %s(between 17 & 30 minutes in length)	1	\$0.75	39s ago	<a href="#">Preview</a>	<a href="#">Qualify</a>
<a href="#">Marina Martin</a>	Transcribe a VIN	1	\$0.03	28s ago	<a href="#">Preview</a>	<a href="#">Accept &amp; Work</a>
<a href="#">Ibotta Turk</a>	Are these receipts the same?	1	\$0.01	32s ago	<a href="#">Preview</a>	<a href="#">Qualify</a>
Description		Time Allotted		Qualifications Required		Your Values
Tell us if two receipts are the same		6 Min		HIT approval rate (%) is greater than 95		100
		Expires in 18h		Total approved HITs is greater than 5000		0 Requirement not met

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Description		Time Allotted		Qualifications Required		Your Values		
Tell us if two receipts are the same		6 Min		✓ HIT approval rate (%) is greater than 95		100		
		Expires in 18h		✗ Total approved HITs is greater than 5000		0 Requirement not met		
2018/10/25						5		

### Filter results:

#### HITs that

- ☐ I'm qualified to work on
- ☐ Require Masters Qualification

[Clear](#) | [Reset](#)

#### Creation Date

- Creation date: oldest first
- ✓ Creation date: newest first

#### Reward Amount

- Reward amount: lowest first
- Reward amount: highest first

#### HITs

- HITs: least first
- HITs: most first

#### Reward

Pays at least \$ 0.01

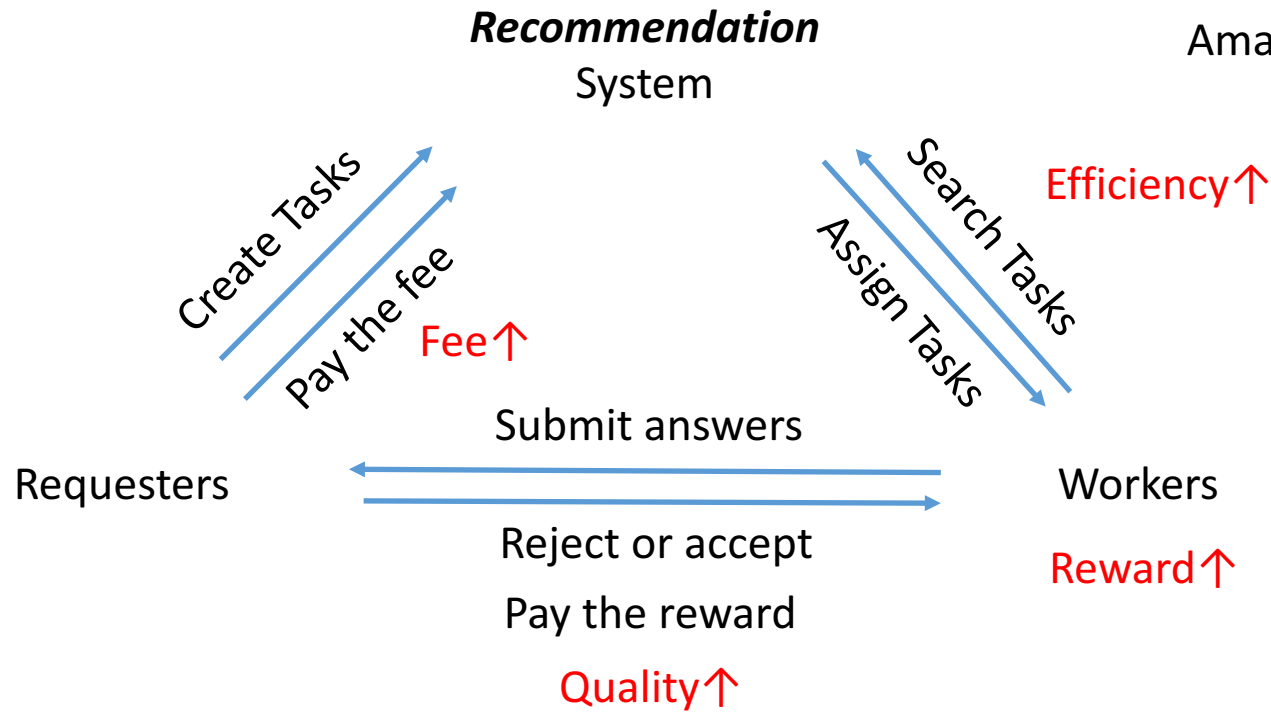
[Cancel](#)

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# Purpose

- Crowdsourcing Workflow

In 2011, a writer in San Francisco, claimed that he earned a measly USD\$ 4.38 for spending eight hours in a day crowdsourcing for Amazon Mechanical Turk.



# Bag-of-Words Approach

- The bag-of-words approach uses the vocabulary of the task description and computes the similarity as the overlap in their vocabularies.

$$bow(t) = \frac{1}{|H|} * \sum_{i=1}^{|H|} c_i * |Voc(t_i) \cap Voc(t)|$$

- $H = \{(t, c)\}$ , the history of a specific user.
- $t$  is the task and its associated features.
- $c$  indicate the scale of preference of the user for the task, here we only consider a binary preference, and therefore  $c \in \{-1, 1\}$ .

# Classification Based Approach

- The bag-of-words approach can not incorporate the other features of a task like timestamp, reward etc.
- Using maximum entropy classifier, the classifier probability can be defined as:

$$Pr(c_i|t) = \frac{1}{Z(t)} \exp \left( \sum_{j=1}^n \lambda_j f_{ij}(c_i, t) \right)$$

- $t$  is a task and associated features.
- $c_i$  is the class, where  $c = 1$  indicates a user will be interested in the task and  $c = -1$  otherwise.
- $f_{ij}$  are feature functions and  $Z(t)$  is a normalizing factor.
- $\lambda_j$  are the weights for the feature functions.



# TaskRank

- Define a score of a task  $t_{ij}$  in category  $c_i$  for a worker  $v_y$  is given as follows:

$$\mathcal{TR}_{i,j}(v_y) = \mathcal{AR}_i(v_y) * \mathcal{CPS}_i(v_y) * \left(1 - \left| \frac{m_{i,j} - \mathcal{RPS}_i(v_y)}{\mathcal{RPS}_i(v_y)} \right| \right) * \left(1 - \left| \frac{e_{i,j} - \mathcal{TPS}_i(v_y)}{\mathcal{TPS}_i(v_y)} \right| \right)$$

- $\mathcal{AR}_i(v_y) = \frac{|T'_i(v_y)|}{|T_i(v_y)|}$ , the acceptance rate of tasks in category  $c_i$  for worker  $v_y$ .
- $\mathcal{CPS}_i(v_y) = \frac{|T_i(v_y)|}{\sum_{p=1}^{c_N} |T_p(v_y)|}$ , task category preference score on category  $c_i$  for worker  $v_y$ .
- $\mathcal{RPS}_i(v_y) = \frac{\sum_{j=1}^{T_N} m_{ij}}{|T_i(v_y)|}$ , reward preference score on category  $c_i$  for worker  $v_y$ .
- $\mathcal{TPS}_i(v_y) = \frac{\sum_{j=1}^{T_N} e_{ij}}{|T_i(v_y)|}$ , time allotted preference score on category  $c_i$  for worker  $v_y$ .

# Recover the worker-task preferring matrix

- To transform workers' behaviors into values as follows:

Worker Behavior		Value
Worker's work done is accepted by requester.	→	5
Worker's work done is rejected by requester.	→	4
Worker completes a task and submits the work done.	→	3
Worker selects a task to work on but not complete it.	→	2
Worker browses the detailed information of a task.	→	1
Worker does not browse the detailed information of a task.	→	0

Yuen, M. C., King, I., & Leung, K. S. (2012, August). Task recommendation in crowdsourcing systems. CrowdKDD

Yuen, M. C., King, I., & Leung, K. S. (2014). TaskRec : A Task Recommendation Framework in Crowdsourcing Systems. Neural Processing Letters

# Recover the worker-task preferring matrix

- Example for worker-task matrix:

	$v_1$	$v_2$	$v_3$	$v_4$	$v_5$	$v_6$
$w_1$		5	2		3	
$w_2$	4			3		4
$w_3$			2			2
$w_4$	5			3		
$w_5$		5	5			3

- Using Probabilistic Matrix Factorization (PMF) to recover this matrix.
- Select the top few of the tasks for recommendation.

Yuen, M. C., King, I., & Leung, K. S. (2012, August). Task recommendation in crowdsourcing systems. CrowdKDD

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# Conclusion and Future work

- Ranking of all tasks to recommend, based on the several factors such as worker history, interest, performance and requester's feedback.
- If a worker gets a list of related recommended tasks:
  - Improving the quality of the task.
  - Increasing the solution efficiency.
  - Worker and system may get more reward.
- These kind of worker history data is difficult to obtain.
  - > Synthetic recommendation system
    - Which can evaluate the performance between different methods.

# References

- Yuen, M. C., King, I., & Leung, K. S. (2012, August). Task recommendation in crowdsourcing systems. In *Proceedings of the First International Workshop on Crowdsourcing and Data Mining* (pp. 22-26). ACM.
- Ambati,V.,Vogel,S.,&Carbonell,J.G.(2011,August).Towards Task Recommendation in Micro-Task Markets. In *Human Computation* (pp. 1- 4).
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- Mnih, Andriy, and Ruslan Salakhutdinov. “Probabilistic matrix factorization.” NIPS 2007