

Modeling Ambiguity, Subjectivity, and Diverging Viewpoints in Opinion Question Answering Systems

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Opinion Question Answering Systems

- Many review websites (Amazon, Ebay, Yelp, Tripadvisor, etc.) do provide community question answering systems, where users can ask and answer item-related, complex and subjective opinion-oriented questions.





Nikon 70-300mm f/4-5.6D ED Auto Focus
Nikkor SLR Camera Lens
by Nikon
 40 customer reviews | 58 answered questions

Available from these sellers.



Used (21) from \$99.93 & FREE shipping. Details

What

Showin

Q: “How will this camera lens work with my Nikon D3300 camera?”

votes
▼
Question: Will it work with a D5300?
Answered by Peter on May 22, 2014

- Ask the community? must wait for a response ☹
- Search for information among reviews? time-consuming to digest ☹
- Can we help users to automatically navigate reviews, in response to a particular question?**

By Peter on May 3, 2013

San Diego Zoo Safari Park

2,837 Reviews | #1 of 50 things to do in Escondido | Certificate of Excellence

Nature & Wildlife Areas, Zoos & Aquariums, Nature & Parks, Outdoor Activities

Overview

Tours & Tickets

Reviews (2,837)



tripadvisor®

48 questions

Ask a question



I'm planning ahead for next summer and I was wondering what I should budget per person for lunch



Tinker Bell



Tinker Bell

if we get there early will we be able to see everything before dinner time? we don't plan on doing any extras just the tram ride that comes with admission and walking through the park. I need to know

Patricia.gillen61
Escondido, California

done to get to and from my hotel by public transport or shared shuttle if you don't have transport

Thank you, Judy

Opinion-oriented question is complicated



**“Is this a good lens
for my Nikon D3300
camera?”**

- Opinion QA vs. traditional community QA
 - Traditional cQA – objective information
 - Can be answered by constructing and exploring a factual knowledge-base
 - Opinion QA – complicated ☹
 - Objective, Subjective, Personal
 - Solution: retrieve relevant reviews rather than address the answer directly (WWW'2016, J. McAuley & A. Yang)

Even more complicated!

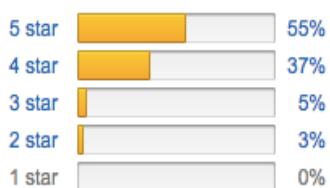


Nikon 70-300mm
f/4-5.6D ED Auto
Focus Nikkor SLR
Camera Lens

Customer Reviews

★★★★★ 40

4.4 out of 5 stars ▾



Multiple Answers

Q: Will this work with the D3300

- **Probably not**, it did not work for AF on my D5000, I got this lens with my N70 years ago, still a good lens though. (**No**)
- **Yes it will** but the autofocus will not. There is no drive motor in the 3000 series cameras. Manual focus works well! (**Yes**)
- Hi, this lens **can not work** autofocus for D3300. Thanks in advance. (**No**)
- The lens **will work** but it will not have autofocus. You would have to focus manually. Rich (**Yes**)

AMBIGUITY

Subjective Reviews

- (1 of 1 people found the following review helpful)

★★★★★ Great price on a 70-300mm lens

... It **will not auto focus** with D3000 series and I knew that. I personally prefer manual focus in larger lenses ... (**No**)

- (0 of 0 people found the following review helpful)

★★★★★ Nikon Nikkor 70-300mm f4-5.6 ED AF lens

... It **works perfectly** on my Nikon D80 ... (**Yes**)

- (0 of 0 people found the following review helpful)

★★★★★ the best for my budget

... Autofocus **works great with** my D70 camera ... (**Yes**)

- (0 of 0 people found the following review helpful)

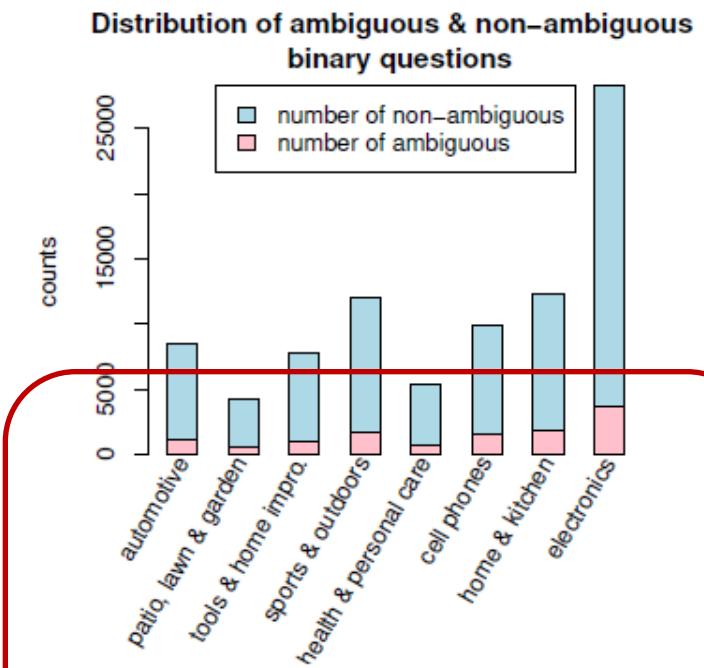
★★★★★ Solid product

... This lens **auto focus greatly with** the D7000 ... (**Yes**)

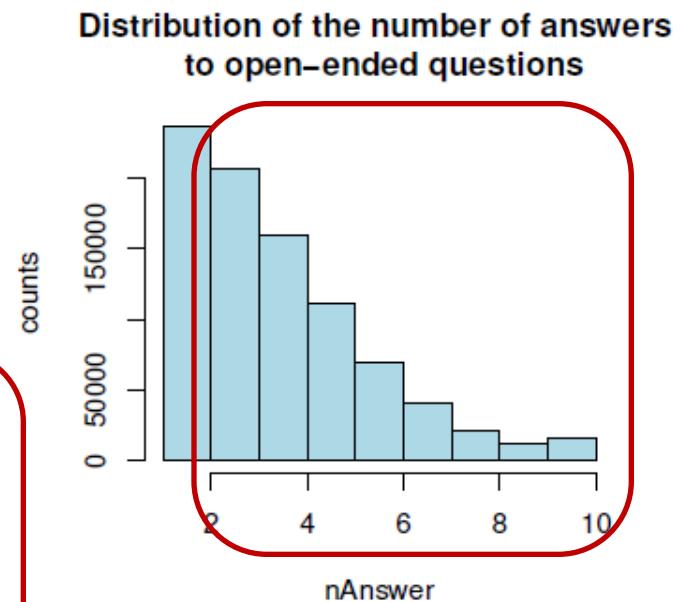
Exploratory Analysis on Amazon QA Data

- QA data from Amazon
 - 808K questions, 3M answers in 8 large categories
- Questions are categorized into two types
 - Binary, Open-ended
- Build a conservative auto-labeler to label binary answers
 - logistic regression
 - keep the top 50% of the most confident predictions so that ambiguity arises due to the questions rather than any errors
- Answer distribution

Binary Question



Open-ended Question



~4 answers per open-ended question in average



Nikon 70-300mm f/4-5.6D ED Auto Focus
Nikkor SLR Camera Lens
by Nikon
★★★★★ 40 customer reviews | 58 answered questions

Available from these sellers.

- High-powered 4.3x telephoto zoom lens with a rotating zoom
- Lens includes HB-15 hood, 62mm lens cap, rear cap



Goal:

- Given an item-related question, we'd like to determine
 - how relevant each review is to the question
 - measured by how helpful it is to identify proper response to the question
 - with emphasis on modeling **ambiguity** and **subjectivity**.

Q See all 3 answers

Question: Will this work on my d3100 DX camera?

Answer: It worked on my D5100, so I guess yes!

By [John Park](#) on September 17, 2014

See all 2 answers

Q 0 votes

Question: will this work for the nikon d3100 and autofocus?

Answer: No. It will autofocus only with cameras that have an autofocus motor such as D70, D7000, D7100.

By [Tomas](#) on May 3, 2013

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Overview Tours & Tickets Reviews (2,837) Q&A (48)



tripadvisor®
48 questions

Ask a question



Firstly, am I able to purchase a day ticket online? Secondly, do you have transport there? Also, am I able to get to and from my hotel by public transport or shared shuttle if you don't have transport? Thank you, Judy

A supervised approach for binary questions

Q: Will this work with the D3300

- Probably not, it did not work for AF on my D5000, I got this lens with my N70 years ago, still a good lens though. (**No**)
- Yes it will but the autofocus will not. There is no drive motor in the 3000 series cameras. Manual focus works well! (**Yes**)
- Hi, this lens can not work autofocus for D3300. Thanks in advance. (**No**)
- The lens would have ... would have manually.



Nikon 70-300mm f/4-5.6D ED Auto Focus Nikkor SLR Camera Lens

A relevant review will help us to identify the proper answer(s) to the question.

Relevance finding → Binary prediction

A pool of observed answers

Task 1: Resolve Labels

A set of votes from reviews

Task 2: Aggregate Predictions

- (1 of 1 people found the following review helpful)

★★★★★ **Great price on a 70-300mm lens**

... It will not auto focus with D3000 series and I knew that. I personally prefer manual focus in larger lenses ...

- (0 of 0 people found the following review helpful)

★★★★★ **Nikon Nikkor 70-300mm f4-5.6 ED AF lens**

... It works perfectly on my Nikon D80 ...

- (0 of 0 people found the following review helpful)

★★★★★ **the best for my budget**

... Autofocus works great with my D70 camera ...

following review helpful)

... with the D70g ...

Resolve Labels

Q: Will this work
with the D3300?

... (No)

... (Yes)

... (No)

... (Yes)

...

- Use the fraction of positive answers $r_q = \frac{n_q^+}{n_q^+ + n_q^-}$ as the label?

$$\text{loglik} = \sum_q \{ r_q \log p_q + (1 - r_q) \log(1 - p_q) \}$$

If we assume the binary answer follows $Bernoulli(r_q)$, this is the summation of the KL-divergences between answers and predictions

- Limitation: real counts of positive and negative labels are discarded!

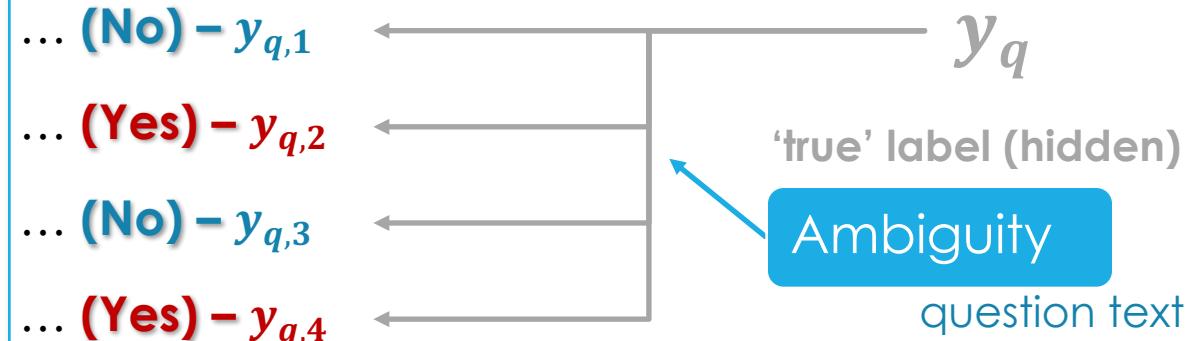
a question with 10+/10- labels (seems more controversial)

a question with 1+/1- labels

- Consider a different assumption for the label generation

Resolve Labels (EM)

Q: Will this work with the D3300?



$$\begin{aligned}\text{'sensitivity'} \alpha_q &:= P(y_{q,j} = \text{yes} | y_q = \text{yes}) = \sigma(\gamma_1, f_q) \\ \text{'specificity'} \beta_q &:= P(y_{q,j} = \text{no} | y_q = \text{no}) = \sigma(\gamma_2, f_q)\end{aligned}$$

Joint distribution:

$$\begin{aligned}a_q &= P(y_{q,1}, \dots, y_{q,n_q} | y_q = \text{yes}, \text{data}) = \alpha_q^{n_q^+} (1 - \alpha_q)^{n_q^-} \\ b_q &= P(y_{q,1}, \dots, y_{q,n_q} | y_q = \text{no}, \text{data}) = (1 - \beta_q)^{n_q^+} \beta_q^{n_q^-}\end{aligned}$$

- Assume the 'true' label y_q of a question is hidden, but we have a set of observed labels $\{y_{q,1}, y_{q,2}, \dots, y_{q,n_q}\}$
- Training: Now embed them into the loglikelihood function (with the hidden 'true' label y_q)

$$\loglik = \sum_q \{y_q \log \mathbf{a}_q p_q + (1 - y_q) \log \mathbf{b}_q (1 - p_q)\}$$

likelihood of observed labels
(generated from the hidden 'true' label)

- Inference (EM-algorithm):
 - E-step: take the expectation of \mathbf{y}_q
 - M-step: optimize $E\loglik$

Aggregate Predictions (MoE)

- Idea:
 - each review (sentence) can be regarded as a weak predictor – give us a vote “yes/no”
 - a relevant review can help to predict a proper label
- Mixture of Experts (MoE):

$$p_q = P(y_q | data) = \sum_r P(r | data) \times P(y_q | r, data)$$

How relevant is r Prediction from r

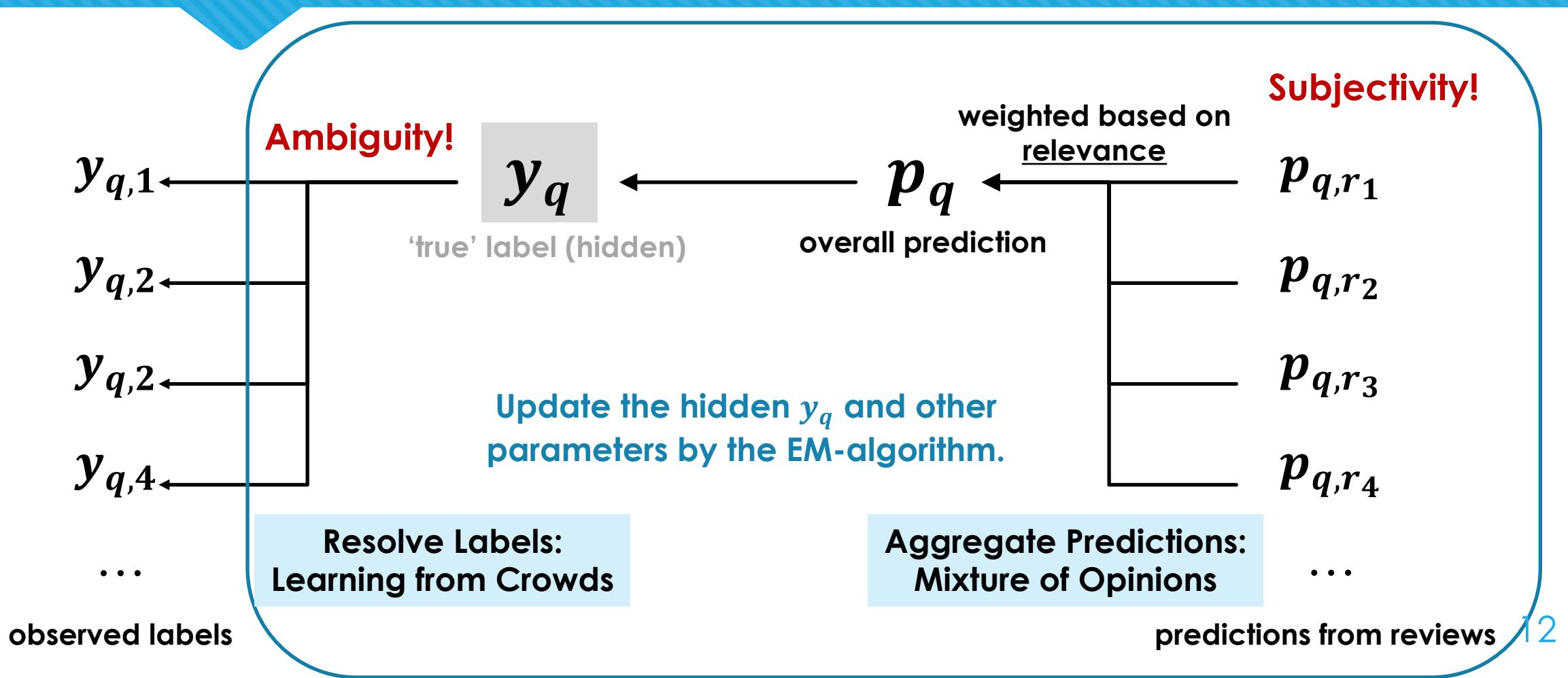
$p_{q,r} = \sigma(w_{q,r})$
pred. from text * (1 + **rating + bias**)

$\propto \exp(v_{q,r})$
text relevance + **helpfulness + expertise**

Subjectivity

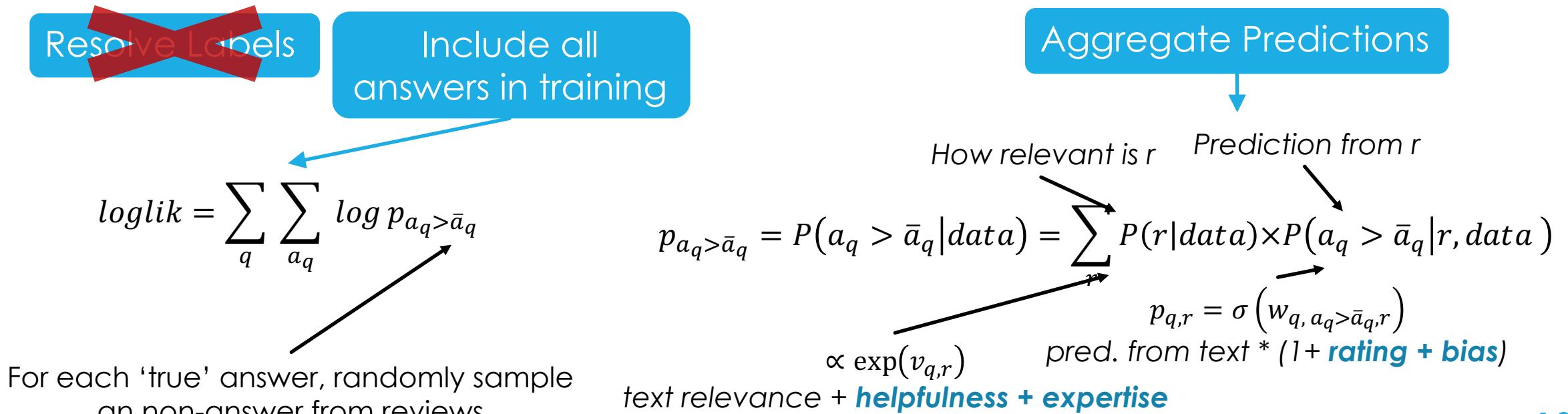
- (1 of 1 people found the following review helpful)
★★★★★ Great price on a 70-300mm lens
... It will not auto focus with D3000 series and I knew that. I personally prefer manual focus in larger lenses ...
(from **user 1**)
- (0 of 0 people found the following review helpful)
★★★★★ Nikon Nikkor 70-300mm f4-5.6 ED AF lens
... It works perfectly on my Nikon D80 ...
(from **user 2**)
- (0 of 0 people found the following review helpful)
★★★★★ the best for my budget
... Autofocus works great with my D70 camera ...
(from **user 3**)
- (0 of 0 people found the following review helpful)
★★★★★ Solid product
... This lens auto focus greatly with the D7000 ...
(from **user 4**)

Model Wrap-Up: EM-MoE



Open-ended Questions

- Do not predict the answer directly, convert it to be a binary task.
- Preference prediction: Rank 'true' answers higher than non-answers



Experiments (Binary Questions)

- Amazon QA Data
- Evaluation measure: Area Under Curve (AUC) for binary prediction
- EM-like methods (with real counts of labels) generally outperform others
- Subjective information only works on large categories
 - We have enough observations to model reviewer bias, expertise, etc.

Gold Standard: labels for non-ambiguous questions

single label (the 1st label)
+ text feature only

label ratio
+ text feature

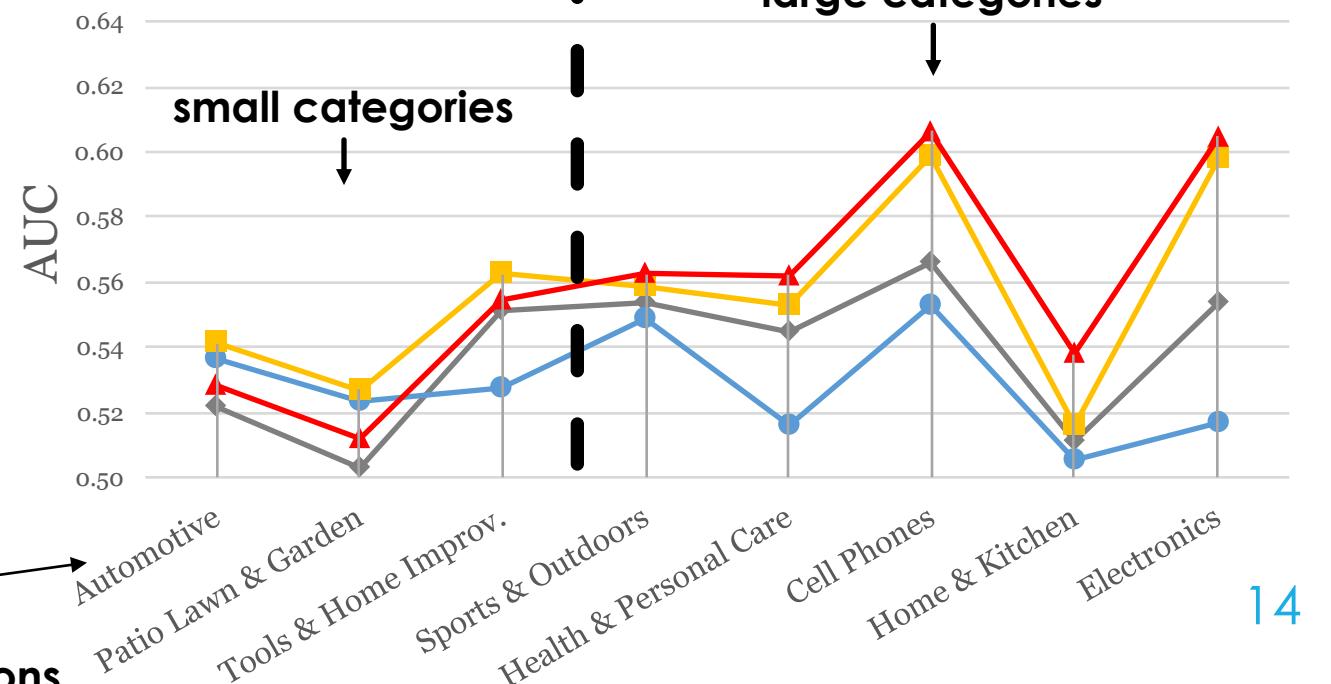
label counts
+ text feature

label counts
+ text feature
+ subjective feature

MoE KL-MoE

EM-MoE

EM-MoE-S

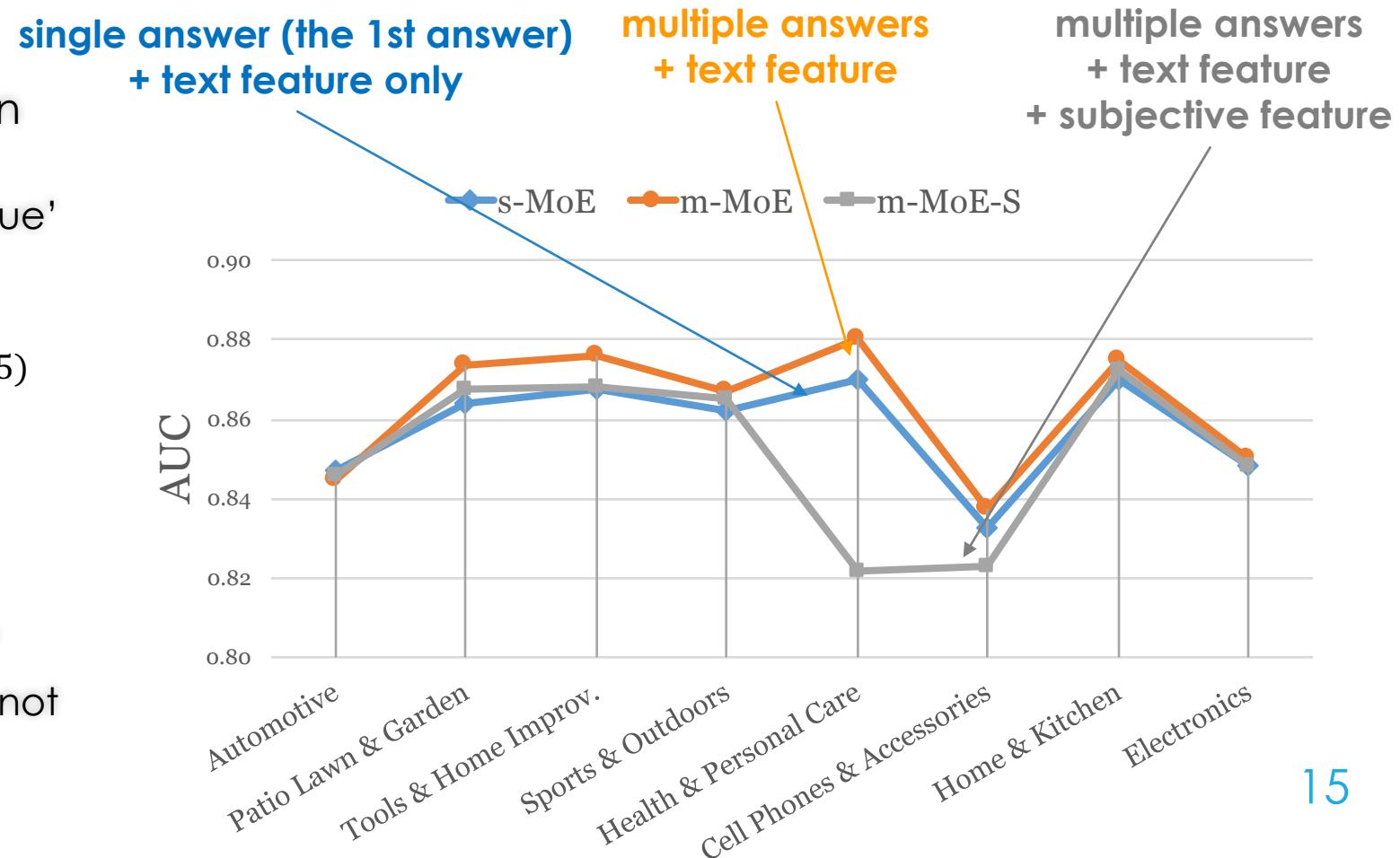


Result (Open-ended Questions)

- AUC for open-ended question
 - measure if the model can successfully distinguish the 'true' answer from non-answers

$$AUC = \frac{1}{|Q|} \sum_q \frac{1}{|A_q|} \sum_{a_q} 1(p_{a_q > \bar{a}_q} > 0.5)$$

- Including multiple answers consistently helps
- Incorporating subjective information was not effective
 - Open-ended questions may not be as polarized as binary questions



Conclusion and Future Direction

- Modeling ambiguity and subjectivity in opinion QA systems
- Resolve labels + Aggregate Subjective Classifiers
- Improvement from subjective information is limited
- A small gap between relevant reviews and direct answers



Thanks!

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