Crowdsourcing for Relevance Evaluation

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A9.com

What Is A9?

- Search technology subsidiary of Amazon.com
- Product search engine
  - Provides search on Amazon.com and other retail sites
  - Creator of “Search Inside the Book”
- Offers Clickriver advertising marketplace
  - Show targeted service ads in the Amazon network

What A9 Isn't

- A destination web search service…
- … though we did some experiments in federated web search a while back
  - Developed OpenSearch standard, used today for Firefox search plugins
- … and some work with geographic location
  - Created BlockView, the first human's-eye view map enhancement

Product Search

- Searching a corpus of retail products
- Data has *more structure* than web
- Search UIs generally support *richer interaction* (sorting, browsing, filtering…)
- Relevance different for every category

Sample queries:

- `oakley sport sunglasses`
- `nintendo ds girls`
- `official euro 2008 soccer ball`
- `nylon repair tape`
- `house`
- `dell 5150`
- `ny giant fleece blanket and pillow`
- `nordic skis`
- `nine west shoes woman`
- `nikon 8x40 action binoculars`

Evaluating Relevance

- Relevance is notoriously hard to evaluate
- Highly subjective
- Expensive to measure

T. Saracevic, “Relevance: A Review of the Literature and a Framework for Thinking on the Notion in Information Science,” *JASIST*, 58(13), 2007.

Human Judgments, Standard Collection

- Predefine test corpora, test queries, and do a one-time relevance assessment.
- Make sets available for re-use in multiple experiments.

Variant 1: Exhaustive Editorial Review

- As found in Cranfield studies (1960s)
- Idea: For a given set of test queries, *read every document in corpus* and assess its relevance to each query.
- Assessors: Typically, students.
- Problem: Doesn't scale when corpus is >5k docs
  - or when docs are longer than a paragraph

Variant 2: Pooling

- As found in TREC (1990s)
- Idea: For a given set of test queries, read the top 100 documents retrieved by any participating IR system.
- Assessors: Retired intelligence analysts.

E. Voorhees, "TREC: Continuing Information Retrieval's Tradition of Experimentation," *Communications of the ACM*, vol 50, no 11, November 2007.

Problems with Standard Collections

- Test sets get stale
- Existing sets may not be appropriate to your domain
- Batch methodology may not be appropriate for measuring your research (e.g. UI)
- Expensive to create new sets
- Breaks down for REALLY big corpora

Variant 3:
New Experiment, New Test

- Usually give up on recall, measure DCG
- Either have small group of students, or group of editors
- Problem: Time-consuming and/or expensive

K. Järvelin, J. Kekäläinen, “Cumulated Gain-based Evaluation of IR Techniques,” *TOIS*, vol. 20, 2002.

Alternative: Automated Metrics

- Rely on existing user behavior to assess performance
  - e.g. click position in interleaved results
- Problems:
  - Need lots of real users
  - Data not re-usable

T. Joachims and F. Radlinski, “Search Engines that Learn from Implicit Feedback,” *IEEE Computer*, vol. 40, no. 8, August 2007.

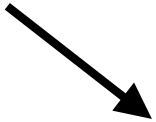
Reconciling Two Approaches

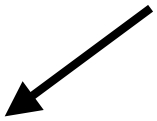
Explicit Judgments

- Reusable
- Flexible

Automated Metrics

- Large scale
- Inexpensive





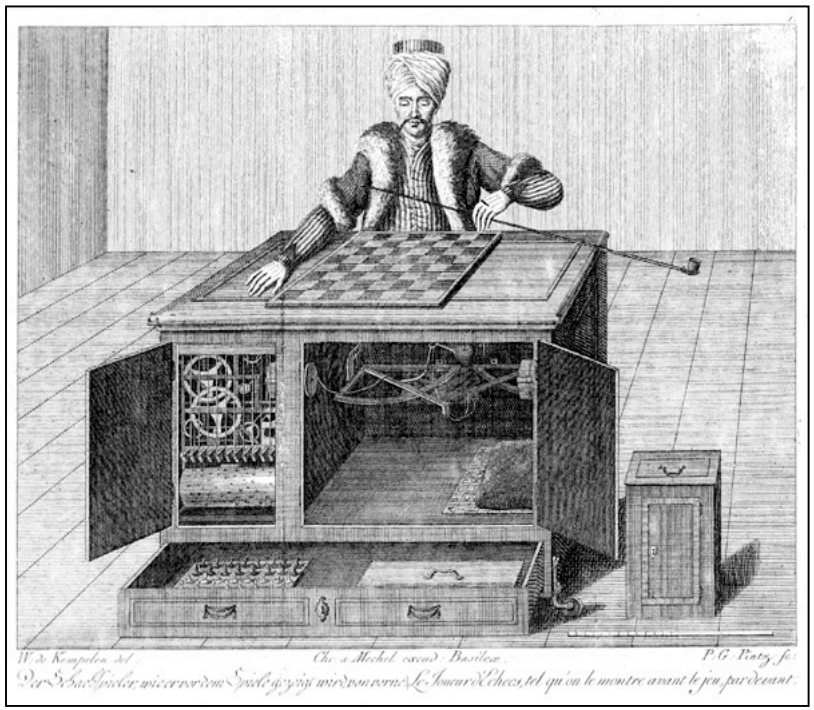
Technique for
Evaluating
Relevance by
Crowdsourcing

Crowdsourcing

"Everyday people using their spare cycles to create content, solve problems, even do corporate R & D."

-- Jeff Howe, "The Rise of Crowdsourcing," *Wired*, June 2006.

Amazon Mechanical Turk (MTurk)



- framework for crowdsourcing
- on-demand workforce
- “artificial artificial intelligence”: get humans to do hard part
- named after faux automaton of 18th C. (really a human)

MTurk: How it works

- Requesters create “Human Intelligence Tasks” (HITs) via web services API.
- Workers (sometimes called “Turkers”) log in, choose HITs, perform them.
- Requesters assess results, pay per HIT satisfactorily completed.
- Currently >200,000 workers from 100 countries; millions of HITs completed
- Currently 21,527 HITs available

Some Sample HITs

- translating text to other languages
- labeling images (x cents each)
- finding “happy hour” times for bars in resort areas

Comment and vote on an article. Easy!					View a HIT in this group
Requester: Product Search	HIT Expiration Date:	Jan 22, 2009 (15 weeks 3 days)	Reward:	$0.03	
	Time Allotted:	3 hours	HITs Available:	642	
Enter 12 pieces of Data.					View a HIT in this group
Requester: Benjamin	HIT Expiration Date:	Oct 6, 2008 (6 hours 49 minutes)	Reward:	$0.04	
	Time Allotted:	11 minutes 40 seconds	HITs Available:	563	
Label images of geological formation					View a HIT in this group
Requester: mtlabel	HIT Expiration Date:	Jan 18, 2009 (14 weeks 6 days)	Reward:	$0.05	
	Time Allotted:	2 hours	HITs Available:	487	
PRE-1 - Get Award or AN Info - ${HITNAME}					View a HIT in this group
Requester: CRS	HIT Expiration Date:	Oct 17, 2008 (1 week 4 days)	Reward:	$0.01	
	Time Allotted:	4 hours	HITs Available:	424	

Hypothetical Relevance Evaluation Task: World Facts

- Want to see whether extracts of CIA World Factbook are relevant to certain locations
- Want test set of (say) 50 queries, and want to judge the first 50 results for each query
  - 2500 query-result pairs

Qualifying Workers

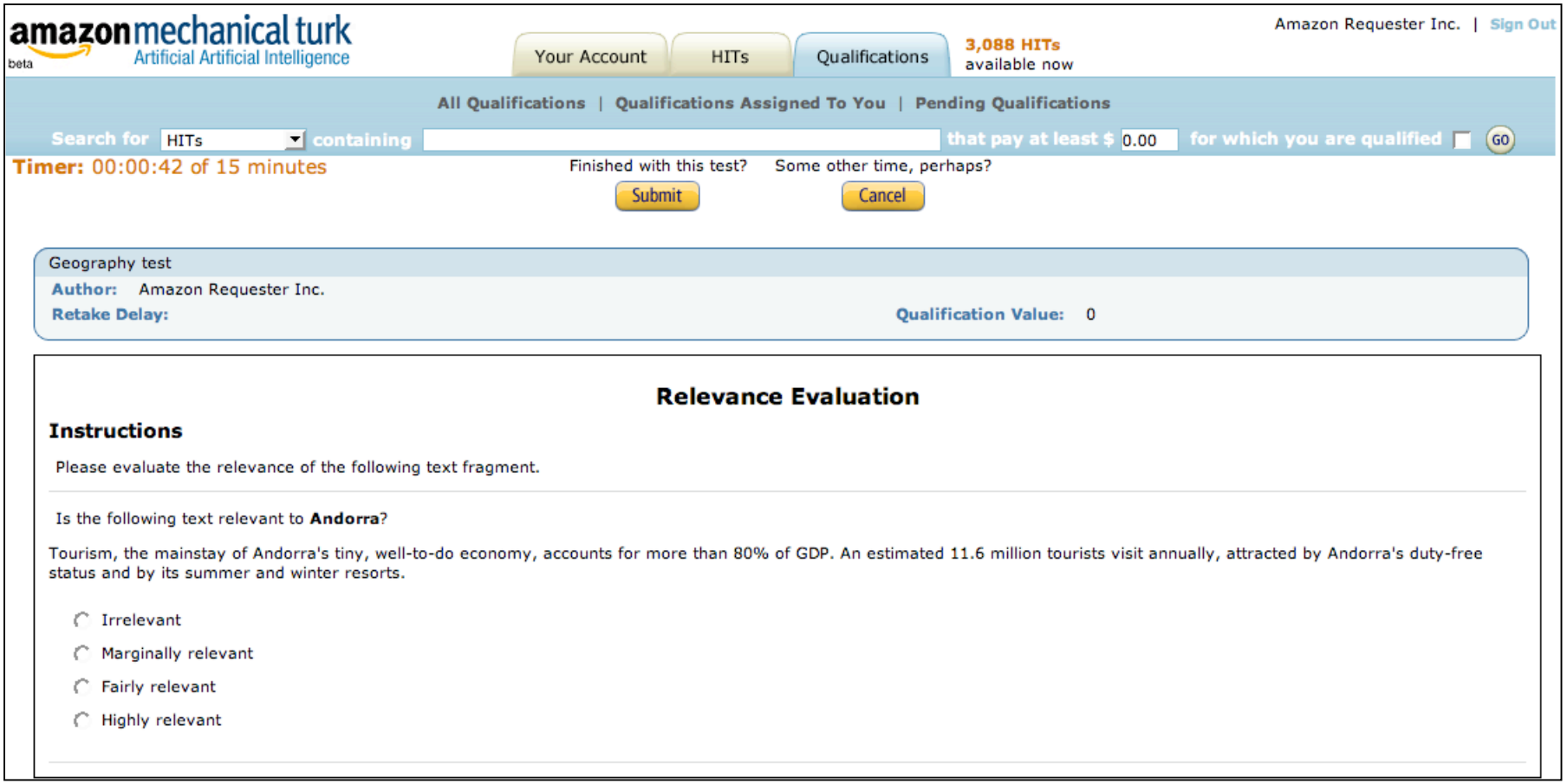
- Requester creates a qualification test
- Ours will be about geography

- Which has a major city named Cairo?
  - Brazil
  - Tunisia
  - Egypt
  - Turkey
- Which is closest to the population of India?
  - 250 million
  - 500 million
  - 750 million
  - 1 billion

Creating HITs

```
<Question>
    <QuestionIdentifier>question1</QuestionIdentifier>
    <DisplayName>Question 1:</DisplayName>
    <IsRequired>true</IsRequired>
    <QuestionContent>
      <FormattedContent><![CDATA[
       Is the following text relevant to Andorra?
   Tourism, the mainstay of Andorra's tiny, well-to-do economy, accounts for
   more than 80% of GDP. An estimated 11.6 million tourists visit annually,
   attracted by Andorra's duty-free status and by its summer and winter
   resorts.
      ]]></FormattedContent>
    </QuestionContent>
    <AnswerSpecification>
      <SelectionAnswer>
        <StyleSuggestion>radiobutton</StyleSuggestion>
        <Selections>
          <Selection>
            <SelectionIdentifier>ir</SelectionIdentifier>
            <Text>Irrelevant</Text>
          </Selection>
                ...
```

Creating HITs



Cost

- We'll pay 1 cent per HIT -- a relevance judgment on a query-result pair
- We'll have 5 workers perform each HIT
- Total cost:

50 queries x 50 results x 5 workers x $0.01

= $125

Quality

- Lots of ways to control quality:
  - Better qualification test
  - More redundant judgments
  - Various methods to aggregate judgments
    - Voting
    - Consensus
    - Averaging
  - Methods to filter bad data
    - Look for patterns
    - Look for outliers

Assessing TERC

Advantages:

- Fast Turnaround
- Low Cost
- High Quality
- Flexibility

Limitations:

- Artificiality of Task
- Unknown Population

Conclusions

- TERC is a viable alternative to traditional relevance evaluation methods
- Amazon Mechanical Turk can provide the crowdsourcing framework for TERC.

Questions?

- For more details:

  O. Alonso, D.E. Rose, B. Stewart, “Crowdsourcing for Relevance Evaluation,” *SIGIR Forum*, December 2008 (forthcoming).

- To learn more about Amazon Mechanical Turk:

  www.mturk.com