MICROTASK CROWDSOURCING TO SOLVE SEMANTIC WEB PROBLEMS

FULL-DAY TUTORIAL @ISWC2013
SYDNEY, AUSTRALIA
TUTORIAL OVERVIEW

• Microtask crowdsourcing is increasingly used to augment the results of algorithms solving Semantic Web problems

• This tutorial covers
  • Fundamentals of microtask crowdsourcing
  • How-to Mechanical Turk (and CrowdFlower)
  • Latest research in microtask crowdsourcing
"Simply defined, crowdsourcing represents the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call. This can take the form of peer-production (when the job is performed collaboratively), but is also often undertaken by sole individuals. The crucial prerequisite is the use of the open call format and the large network of potential laborers."

[Howe, 2006]
CROWDSOURCING COMES IN DIFFERENT FORMS AND FLAVORS
IN THIS TUTORIAL: CROWDSOURCING AS HUMAN COMPUTATION

Outsourcing tasks that machines find difficult to solve to humans
IN THIS TUTORIAL: MICROTASK CROWDSOURCING

Work is broken down into smaller pieces that can be solved independently.
AGENDA FOR TODAY

<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microtask crowdsourcing fundamentals</td>
<td>09:15 – 10:30</td>
</tr>
<tr>
<td>Coffee break</td>
<td>10:30 – 11:00</td>
</tr>
<tr>
<td>MTurk hands-on</td>
<td>11:00 – 12:45</td>
</tr>
<tr>
<td>Lunch break</td>
<td>12:45 – 13:45</td>
</tr>
<tr>
<td>Microtask management and quality control</td>
<td>13:45 – 15:30</td>
</tr>
<tr>
<td>Coffee break</td>
<td>15:30 – 16:00</td>
</tr>
<tr>
<td>Applications to the Semantic Web</td>
<td>16:00 – 17:00</td>
</tr>
<tr>
<td>Current research directions</td>
<td>17:00 – 17:15</td>
</tr>
<tr>
<td>Wrap-up</td>
<td>17:15 – 17:30</td>
</tr>
</tbody>
</table>
PRESENTERS

• Gianluca Demartini
  • MSc University of Udine, Italy
  • PhD University of Hannover, Germany on Entity Retrieval
  • Worked for UC Berkeley (on crowdsourcing); Yahoo! Research, Spain; L3S Research Center, Germany
  • PostDoc eXascale Infolab, University Fribourg, Switzerland
  • Lecturer for Social Computing in Fribourg
  • Tutorial on Entity Search at ECIR 2012

• Research interests
  • Information retrieval
  • Social and Semantic Web

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PRESENTERS

• Elena Simperl
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    FU Berlin, Germany
  • Worked for FU Berlin,
    Germany; STI Innsbruck,
    Austria; KIT, Germany
  • Senior lecturer WAIS,
    University of Southampton,
    UK
  • Coordinator of Insemtives
    project and tutorials at
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  • Research interests
    • Social computing
    • Semantic technologies
  
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PRESENTERS

• Maribel Acosta
  • MSC in Computer Science University Simon Bolivar, Venezuela
  • Worked for University Simon Bolivar, Venezuela
  • PhD student, KIT, Germany

• Research interests
  • Data base management
  • Linked Data query processing
  • Social Web

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WEB SITE: HTTPS://SITES.GOOGLE.COM/SITE/MICROTASKTUTORIAL/

SLIDES AND EXERCISES: HTTPS://GITHUB.COM/MARIBELACOSTA/CROWDSOURCING-TUTORIAL

FULL-DAY TUTORIAL ISWC2013
SYDNEY AUSTRALIA
MICROTASK CROWDSOURCING FUNDAMENTALS

ELENA SIMPERL
UNIVERSITY OF SOUTHAMPTON
MICROTASK CROWDSOURCING

Work is broken down into smaller ('micro') pieces that can be solved independently.
MICROTASK CROWDSOURCING FUNDAMENTALS

DIMENSIONS OF MICROTASK CROWDSOURCING

11/19/2013
Tutorial@ISWC2013
DIMENSIONS OF MICROTASK CROWDSOURCING

WHAT IS OUTSOURCED

• *Tasks based on human skills not easily replicable by machines*
  • Visual recognition
  • Language understanding
  • Knowledge acquisition
  • Basic human communication
  • ...

WHO IS THE CROWD

• Open call (crowd accessible through a platform)
  • Call may target specific skills and expertise (qualification tests)
  • Requester typically knows less about the ‘workers’ than in other ‘work’ environments

See also [Quinn & Bederson, 2012]
DIMENSIONS OF MICROTASK CROWDSOURCING (2)

HOW IS THE TASK OUTSOURCED

- Explicit vs. implicit participation
- Tasks broken down into smaller units undertaken in parallel by different people
- Coordination required to handle cases with more complex workflows
- Partial or independent answers consolidated and aggregated into complete solution

See also [Quinn & Bederson, 2012]
EXAMPLE: CITIZEN SCIENCE VIA MICROTAKS CROWDSOURCING

WHAT IS OUTSOURCED

• Object recognition, labeling, categorization in media content

WHO IS THE CROWD

• Anyone

HOW IS THE TASK OUTSOURCED

• Highly parallelizable tasks
• Every item is handled by multiple annotators
• Every annotator provides an answer
• Consolidated answers solve scientific problems
A LARGE, BUT NOT ALWAYS DIVERSE CROWD

Country of residence
- United States: 46.80%
- India: 34.00%
- Miscellaneous: 19.20%

Make Money by working on HITs

HITs - Human Intelligence Tasks - are individual tasks that you work on. Find HITs now.

As a Mechanical Turk Worker you:
- Can work from home
- Choose your own work hours
- Get paid for doing good work

Get Results from Mechanical Turk Workers

Ask workers to complete HITs - Human Intelligence Tasks - and get results using Mechanical Turk. Register Now.

As a Mechanical Turk Requester you:
- Have access to a global, on-demand, 24 x 7 workforce
- Get thousands of HITs completed in minutes
- Pay only when you're satisfied with the results
SIGNIFICANT AMOUNT OF RESOURCES AND TIMELY DELIVERY
SIGNIFICANT AMOUNT OF RESOURCES AND TIMELY DELIVERY (2)

60% of workers spend more than 4 hours a week on MTurk

http://www.mturk-tracker.com/
BROAD RANGE OF TASKS

Business Data
Collect data on businesses at massive scale

Content Moderation and Curation
Quickly find both good and bad user generated content

Ranked
Boost conversions with better search results

Content Generation
Improve your search engine ranking with quality content

Custom solutions
We help businesses of all sizes automate really big custom projects

Customer and Lead Data Enhancement
Increase sales by knowing more about your customers

Sentiment and Opinion Analysis
Know exactly what people are saying about you

Categorize
Categorize products, businesses, videos, events, & more

Surveys
Find and interact with highly-qualified digital consumers

Builder
Advanced user? Developer? Build your own crowdsourcing projects
IT’S NOT ALWAYS JUST ABOUT MONEY

Worker’s Motivation in Crowdsourcing

Intrinsic Motivation
- Enjoyment Based Motivation
  - Skill Variety
  - Task Identity
  - Task Autonomy
  - Direct Feedback from the Job
  - Pacing

- Community Based Motivation
  - Community Identification
  - Social Contact

Extrinsic Motivation
- Immediate Payoffs
  - Payment

- Delayed Payoffs
  - Signaling
  - Human Capital Advancement

- Social Motivation
  - Action Significance by External Values
  - Action Significance by External Obligations & Norms
  - Indirect Feedback from the Job

Figure 1: A Model for Worker’s Motivation in Crowdsourcing

[Kaufmann, Schulze, Viet, 2011]

http://www.crowdsourcing.org/editorial/how-to-motivate-the-crowd-infographic/

http://www.oneskyapp.com/blog/tips-to-motivate-participants-of-crowdsourced-translation/
EXPLICIT VS. IMPLICIT CONTRIBUTION - AFFECTS MOTIVATION AND ENGAGEMENT

Users aware of how their input contributes to the achievement of application’s goal (and identify themselves with it)

vs.

Tasks are hidden behind the application narratives. Engagement ensured through other incentives
COMPLEX WORKFLOWS CANNOT ALWAYS BE DIRECTLY IMPLEMENTED

WHAT IS OUTSOURCED
- Text shortening, proof-reading, open editing

WHO IS THE CROWD
- MTurk

HOW IS THE TASK OUTSOURCED
- Text divided into paragraphs
- Select-fix-verify pattern
- Multiple workers in each step

See also [Bernstein et al., 2010]

http://www.youtube.com/watch?v=n_miZqsPwsc
DIMENSIONS OF MICROTASK CROWDSOURCING (3)

HOW ARE THE RESULTS VALIDATED

- Solutions space closed vs. open
- Performance measurements/ground truth
- Statistical techniques employed to predict accurate solutions
- May take into account confidence values of algorithmically generated solutions

HOW CAN THE PROCESS BE OPTIMIZED

- Incentives and motivators
- Assigning tasks to people based on their skills and performance (as opposed to random assignments)
- Symbiotic combinations of human- and machine-driven computation, including combinations of different forms of crowdsourcing

See also [Quinn & Bederson, 2012]
Selecting the right option vs. assessing the quality of the work

The goal is to undertake much of the assessment either automatically or use the crowd for it.

draw a sheep facing to the left.
MEASURING PERFORMANCE CAN BE CHALLENGING

WHO AND HOW

- Redundancy
- Excluding spam and obviously wrong answers
- Voting and ratings by the crowd
- Assessment by the requester
- Where does the ground truth come from and is it needed
  - Note: improving recall of algorithms

WHEN

- Real-time constraints in games
ALIGNING INCENTIVES IS ESSENTIAL

Motivation: driving force that makes humans achieve their goals

Incentives: ‘rewards’ assigned by an external ‘judge’ to a performer for undertaking a specific task

- Common belief (among economists): incentives can be translated into a sum of money for all practical purposes.

Incentives can be related to both extrinsic and intrinsic motivations.

Extrinsic motivation if task is considered boring, dangerous, useless, socially undesirable, dislikable by the performer.

Intrinsic motivation is driven by an interest or enjoyment in the task itself.
PRICING ON MTURK

[Ipeirotis, 2008]
HYBRID SYSTEMS

Virtual world
(Network of
social interactions)

Model of social interaction

Design and composition

Participation and data supply

Physical World
(people and devices)

Dave Robertson
**EXAMPLE: HYBRID DATA INTEGRATION**

<table>
<thead>
<tr>
<th>paper</th>
<th>conf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data integration</td>
<td>VLDB-01</td>
</tr>
<tr>
<td>Data mining</td>
<td>SIGMOD-02</td>
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</tbody>
</table>

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<tr>
<th>title</th>
<th>author</th>
<th>email</th>
<th>venue</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLAP</td>
<td>Mike</td>
<td>mike@a</td>
<td>ICDE-02</td>
</tr>
<tr>
<td>Social media</td>
<td>Jane</td>
<td>jane@b</td>
<td>PODS-05</td>
</tr>
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Generate plausible matches

- paper = title, paper = author, paper = email, paper = venue
- conf = title, conf = author, conf = email, conf = venue

Ask users to verify

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Does attribute paper match attribute author?

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Yes | No | Not sure

McCann, Shen, Doan: Matching Schemas in Online Communities. ICDE, 2008
EXAMPLE: HYBRID QUERY PROCESSING

Use the crowd to answer DB-hard queries

Where to use the crowd:
Find missing data
Make subjective comparisons
Recognize patterns

But not:
Anything the computer already does well

M. Franklin, D. Kossmann, T. Kraska, S. Ramesh and R. Xin.
CrowdDB: Answering Queries with Crowdsourcing, SIGMOD 2011
MICROTASK CROWDSOURCING FUNDAMENTALS

IN THIS TUTORIAL
PAID MICROTASK CROWDSOURCING
COMPONENTS OF A MICROTASK PLATFORM

- Task design and workflow support
- Crowd and crowd selection
- Task assignment and publication
- Rewards
- Qualification tests and quality assurance
- Interface and programming support
Simple tasks, grouped in batches

Reward set by requester, fixed + bonus

US/India Location Acceptance rate Masters

Newer tasks on top of the list

Qualification tests

UI and SDK
CROWDFLOWER

- Stronger quality control by platform providers
- No restrictions to US-based requesters
- Aggregator, also uses MTurk crowd
you send samasource a project

women, youth, and refugees complete work

samasource breaks it down into microwork

samasource compiles work and assures quality

work is allocated to our service partners

your project gets delivered and helps reduce poverty
MOBILEWORKS

- Workers from South America
- Quality assurance by selected crowd members
- Reward decided by platform provider based on complexity of the tasks
MANY OTHER PLATFORMS

Need to get work done?  
Want to earn money now?

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MICROTASK CROWDSOURCING FUNDAMENTALS

SUMMARY
SUMMARY

- Microtask crowdsourcing works best for tasks that computers find challenging
- Apply it for simple, repetitive tasks that can be clearly scoped and described
- Think about what you can pre-compute automatically
- Think about task design and phrasing of questions
- Complex workflows require additional effort
- Think about quality assurance, validation, aggregation of results, and task assignment
- Time is sometimes of essence
- It is not always about the financial reward
- There are more platforms out there beyond MTurk