:

Fundamentals of Microtask Crowdsourcing

Amrapali Zaveri

Microtask Crowdsourcing

Work is broken down into smaller (“micro”) pieces that can be solved independently.

Outline

1. **Dimensions of Microtask Crowdsourcing**
2. Microtasks: Terminology
3. Creating Microtasks
4. Microtask Platforms: Figure Eight and CrowdFlower
5. Summary

Dimensions of Microtask Crowdsourcing

What

Tasks based on human skills not easily solvable by machines:

- Visual recognition
- Language understanding
- Knowledge acquisition
- Human communication
- Many others

Who

- Open call or crowd accessible through a platform
- Call may target specific skills and expertise
- The crowd is composed of a large pool of (unknown) people

How

- Tasks are broken down into smaller units undertaken in parallel by different people
- Partial answers are consolidated and aggregated into a complete solution
- Coordination is required to handle cases with more complex workflows

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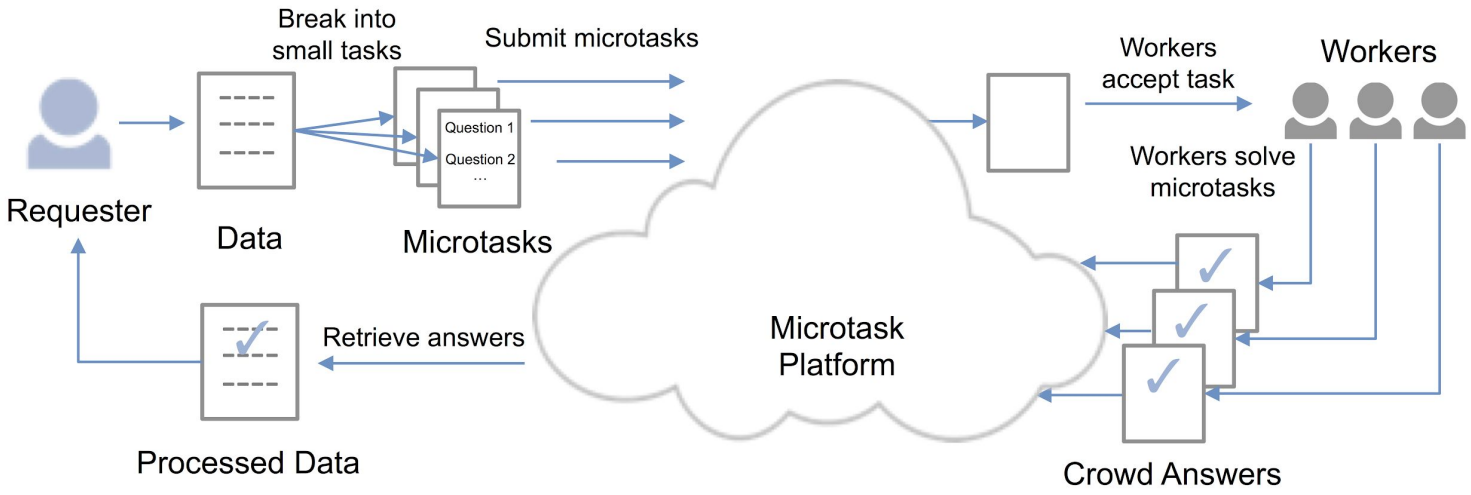
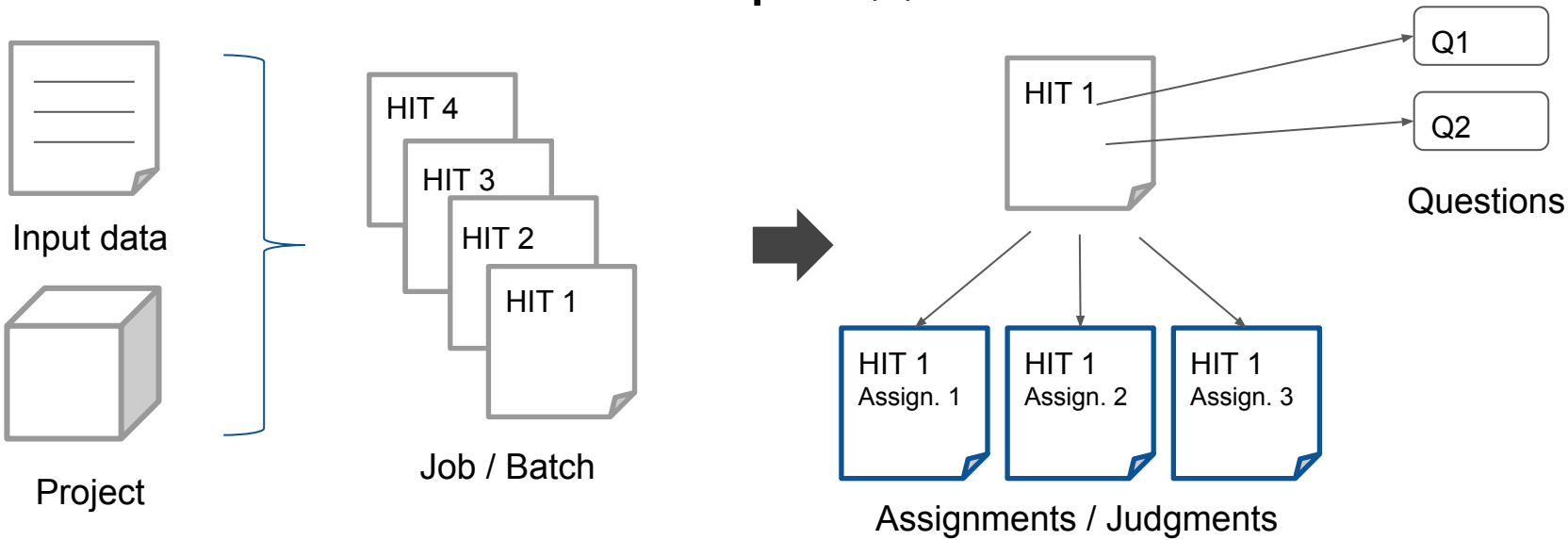
Microtask Crowdsourcing Process



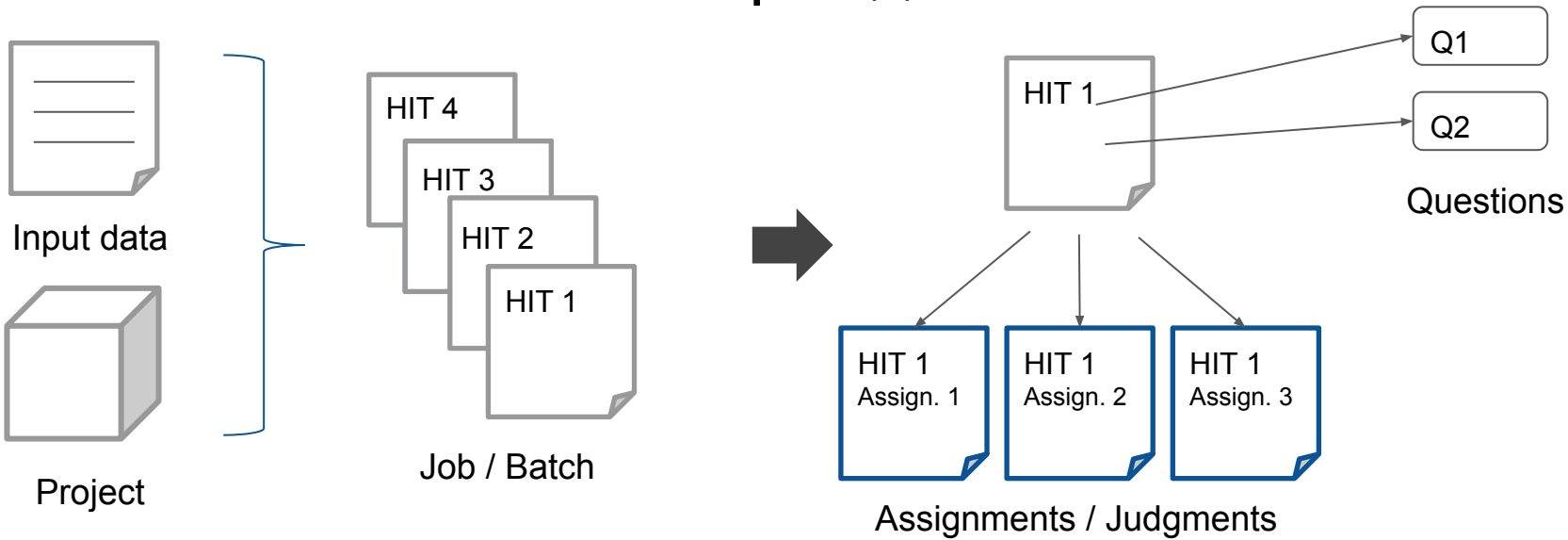
- **Requester:** Creates and submits microtasks to the platform.
- **Microtask or Human Intelligence Task (HIT):** Work unit.
- **Worker:** Person who solves tasks.

Microtasks: Basic Concepts (1)



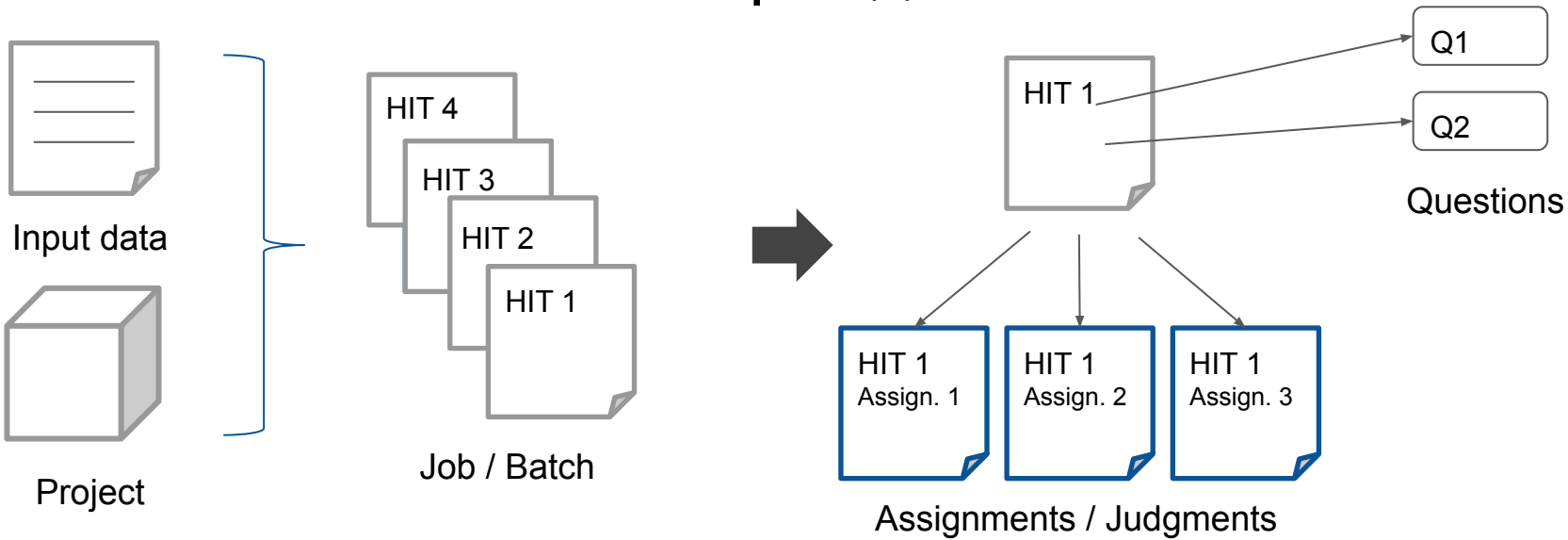
- **Input data:** Typically, a CSV or TSV file where
  - Each column corresponds to a variable
  - Each row is a question
  - Each file corresponds to a job / batch

Microtasks: Basic Concepts (2)



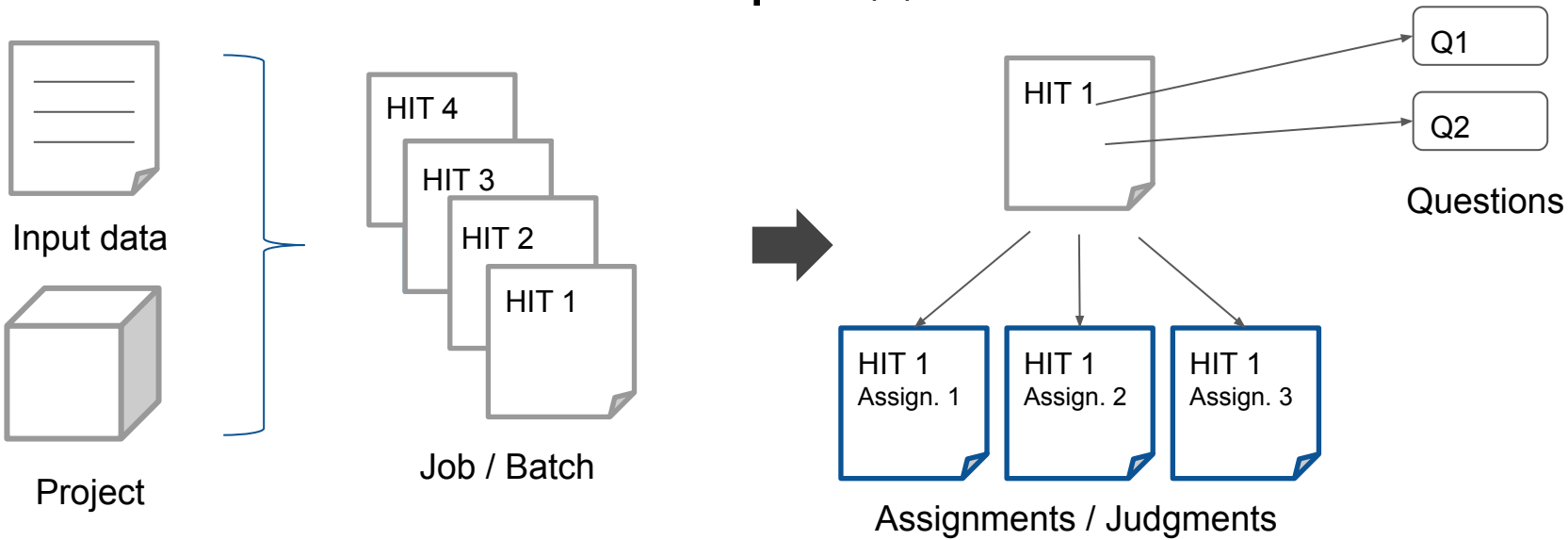
- **Project:** Includes the template for the microtask interface and further metadata
  - The template for the interface can reference columns (variables) in the input data
  - All the microtasks generated within a project have the same properties (payment, quality control, duration, etc.)

Microtasks: Basic Concepts (3)



- **Job / Batch:** Group of microtasks or HITs created in a project based on the input data
- **Questions:** Individual questions inside of a microtask.
- **Assignments / Judgments:** Answer from a worker to a microtask. The number of assignments determine the redundancy per microtask.

Microtasks: Basic Concepts (4)



Total cost = No. of HITs in Job x No. of assignments x (Reward per HIT + Platform Fee)

Example: Input Data, HITs, and Questions

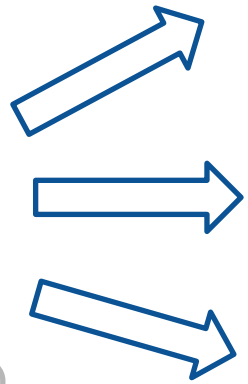
- Problem: Tagging (describing) images

image_url
https://s3.amazonaws.com/pichost/segmentor/us101/IMG_9008.JPG
https://s3.amazonaws.com/pichost/segmentor/us101/IMG_8982.JPG
https://s3.amazonaws.com/pichost/segmentor/us101/IMG_9016.JPG
https://s3.amazonaws.com/pichost/segmentor/us101/IMG_9017.JPG
https://s3.amazonaws.com/pichost/segmentor/us101/IMG_9018.JPG
https://s3.amazonaws.com/pichost/segmentor/us101/IMG_9020.JPG
https://s3.amazonaws.com/pichost/segmentor/us101/IMG_9023.JPG
https://s3.amazonaws.com/pichost/segmentor/us101/IMG_8984.JPG
https://s3.amazonaws.com/pichost/segmentor/us101/IMG_9026.JPG
https://s3.amazonaws.com/pichost/segmentor/us101/IMG_9027.JPG

Input data:
900 images

Create tags for image
{{image_url}}

Project



HIT: Create tags for image IMG_9008.JPG

HIT: Create tags for image IMG_8982.JPG

…

No. of HITs = 900

Example: Input Data, HITs, and Questions

- Problem: Tagging (describing) images

image_url
https://s3.amazonaws.com/pichost/segmentor/us101/IMG_9008.JPG
https://s3.amazonaws.com/pichost/segmentor/us101/IMG_8982.JPG
https://s3.amazonaws.com/pichost/segmentor/us101/IMG_9016.JPG
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https://s3.amazonaws.com/pichost/segmentor/us101/IMG_9027.JPG

Input data:
900 images

Create tags for image
{{image_url}}

Project

HIT: Create tags for image
IMG_9008.JPG,
IMG_8982.JPG,
IMG_9016.JPG

HIT: Create tags for image
IMG_9017.JPG,
IMG_9018.JPG,
IMG_9020.JPG

Several questions in a HIT!

…

No. of HITs = 300

Instead of 900 HITs

Properties of a Project

- **General information:** includes title and (short) description of the HIT. Depending on the platform, requester can specify keywords which are used by workers for searching HITs.
- **Microtask duration time:** time allotted to solve a HIT.
- **Microtask life time:** how long will the HIT be available on the platform.
- **Redundancy:** number of different persons that assess the exact same HIT.
- **Reward:** payment for correctly solving an assignment.
- **Quality control:** settings to improve the quality of the results (more about this topic in the next lecture)

Summary of Terms

Figure Eight (CrowdFlower)	Amazon Mechanical Turk	Meaning
Requester / Customer	Requester	Person who submits a microtask.
Page	Human Intelligence Task (HIT)	Microtask to be solved.
Row	Question	A question in a microtask.
Job	Batch	Group of microtasks.
Contributor	Worker / Turker	Person who solves the microtask.
Judgements per Row	Assignments	Number of distinct persons that complete the same microtask (redundancy).
Judgements	Responses	Answers from the crowd for a microtask.
Payment	Reward	Payment granted to a worker for completing a microtask.
Quality Control	Qualification Types	Quality control mechanisms.

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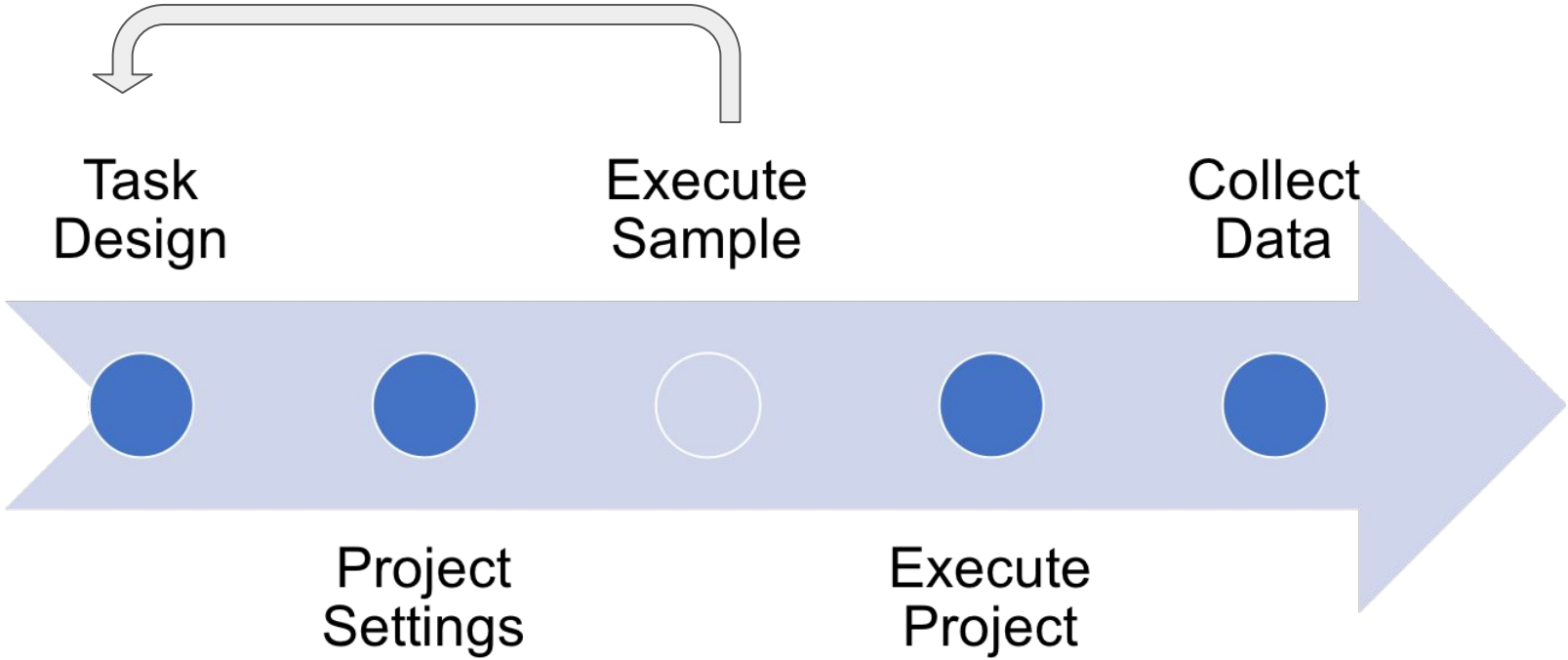
Creating Microtasks: Typical Workflow



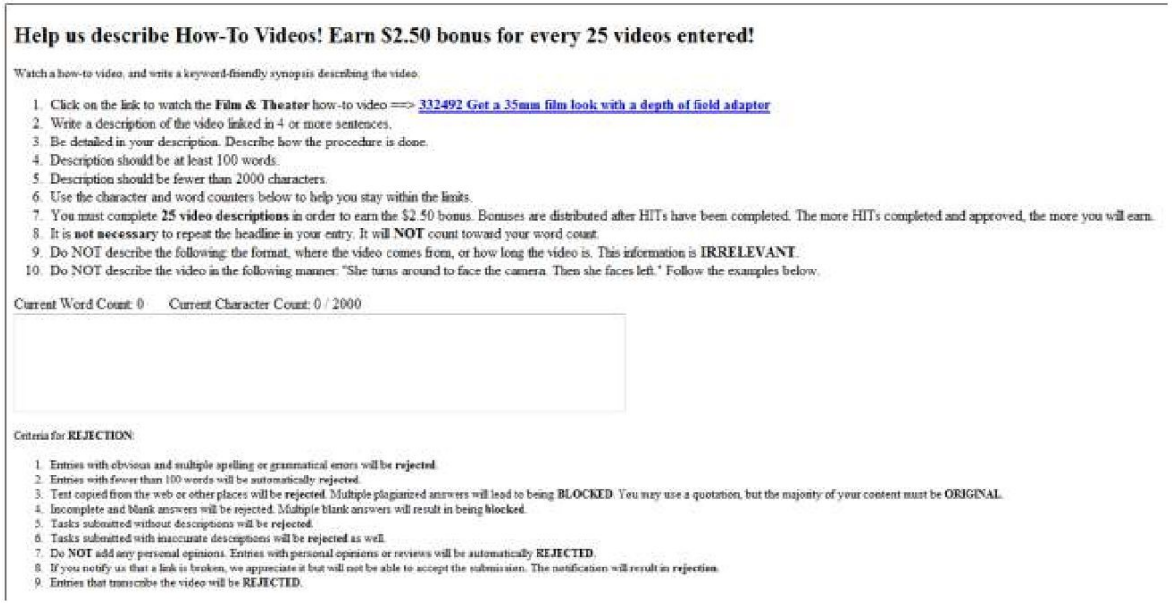
Task Design

- The design on the task impacts on:
  - **The quality of the crowd answers**
  - **The time performance of the crowd**
- Ask the right questions
- Provide clear instructions
- Show examples

Reduce ambiguity

- Workers may not be experts: Do not assume the same understanding of terms. Simplify the wording.

Example: Bad Task Design



Help us describe How-To Videos! Earn $2.50 bonus for every 25 videos entered!

Watch a how-to video, and write a keyword-friendly synopsis describing the video.

1. Click on the link to watch the **Film & Theater** how-to video ==> 332492 Get a 35mm film look with a depth of field adaptor
2. Write a description of the video linked in 4 or more sentences.
3. Be detailed in your description. Describe how the procedure is done.
4. Description should be at least 100 words.
5. Description should be fewer than 2000 characters.
6. Use the character and word counters below to help you stay within the limits.
7. You must complete **25 video descriptions** in order to earn the $2.50 bonus. Bonuses are distributed after HITs have been completed. The more HITs completed and approved, the more you will earn.
8. It is **not necessary** to repeat the headline in your entry. It will **NOT** count toward your word count.
9. Do NOT describe the following: the format, where the video comes from, or how long the video is. This information is **IRRELEVANT**.
10. Do NOT describe the video in the following manner: "She turns around to face the camera. Then she faces left." Follow the examples below.

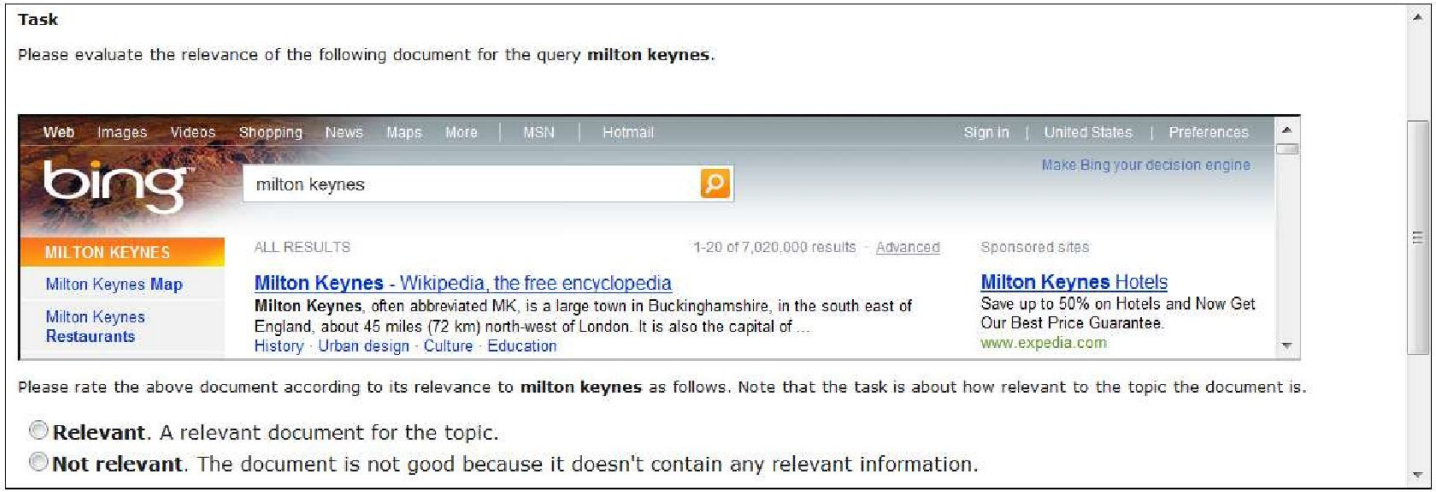
Current Word Count: 0 Current Character Count: 0 / 2000

Criteria for **REJECTION**:

1. Entries with obvious and multiple spelling or grammatical errors will be **rejected**.
2. Entries with fewer than 100 words will be automatically **rejected**.
3. Text copied from the web or other places will be **rejected**. Multiple plagiarized answers will lead to being **BLOCKED**. You may use a quotation, but the majority of your content must be **ORIGINAL**.
4. Incomplete and blank answers will be rejected. Multiple blank answers will result in being **blocked**.
5. Tasks submitted without descriptions will be **rejected**.
6. Tasks submitted with inaccurate descriptions will be **rejected** as well.
7. Do **NOT** add any personal opinions. Entries with personal opinions or reviews will be automatically **REJECTED**.
8. If you notify us that a link is broken, we appreciate it but will not be able to accept the submission. The notification will result in rejection.
9. Entries that transcribe the video will be **REJECTED**.

- Asking too much
- Task is not engaging

Example: Good Task Design



All information is available:

- What to do
- Question to answer
- Relevant resources (search result) is included in the task

Task Design: General Recommendations

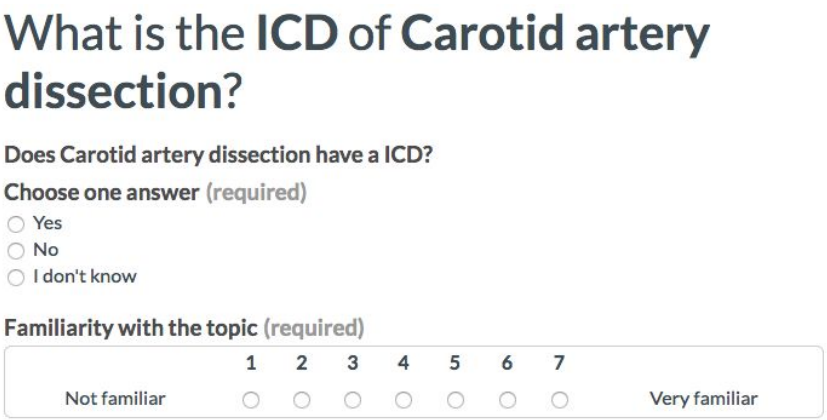
- Microtasks should be self-contained
- Keep it short and simple. Brief and concise
- Be very clear with the relevance of the task
- Engage with the worker. Avoid “boring” tasks
- Request feedback:
  - Including an optional open-ended question (input box) in the task
  - Some platforms (e.g., Figure Eight) have built-in surveys for collecting worker feedback

Other Design Principles

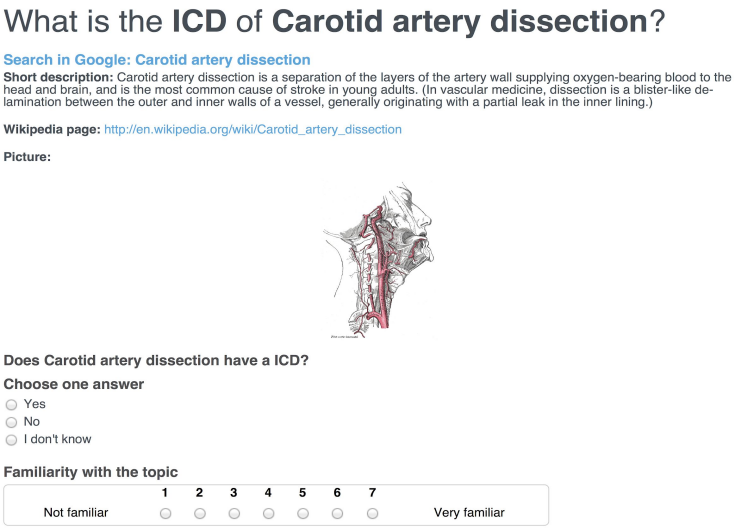
- Presentation: text alignment and legibility
- Reading level: complexity of words and sentences
- Attractiveness: worker’s attention & enjoyment
- Special needs communities (e.g. simple color blindness)
- Cognitive load: mental rigor needed to perform task
- Multi-cultural / multi-lingual

Impact of Task Design on Crowd Accuracy:
Completing Life Sciences Knowledge Graphs

Simple Task Interface:



"Enriched" Task Interface:



M. Acosta, E. Simperl, F. Flöck, M.E. Vidal. *Enhancing Answer Completeness of SPARQL Queries via Crowdsourcing.* Journal of Web Semantics, 2017.

Impact of Task Design on Crowd Accuracy:
Completing Life Sciences Knowledge Graphs

Simple Task Interface:

What is the **ICD** of **Carotid artery dissection**?

Does Carotid artery dissection have a ICD?

Choose one answer (required)

- Yes
- No
- I don't know

Familiarity with the topic (required)

	1	2	3	4	5	6	7	
Not familiar	○	○	○	○	○	○	○	Very familiar

Average F1 = 0.624

"Enriched" Task Interface:

What is the **ICD** of **Carotid artery dissection**?

Search in Google: Carotid artery dissection

Short description: Carotid artery dissection is a separation of the layers of the artery wall supplying oxygen-bearing blood to the head and brain, and is the most common cause of stroke in young adults. (In vascular medicine, dissection is a blister-like de-lamination between the outer and inner walls of a vessel, generally originating with a partial leak in the inner lining.)

Wikipedia page: http://en.wikipedia.org/wiki/Carotid_artery_dissection

Picture:

Does Carotid artery dissection have a ICD?

Choose one answer

- Yes
- No
- I don't know

Familiarity with the topic

	1	2	3	4	5	6	7	
Not familiar	○	○	○	○	○	○	○	Very familiar

Average F1 = 0.924

M. Acosta, E. Simperl, F. Flöck, M.E. Vidal. *Enhancing Answer Completeness of SPARQL Queries via Crowdsourcing.* Journal of Web Semantics, 2017.

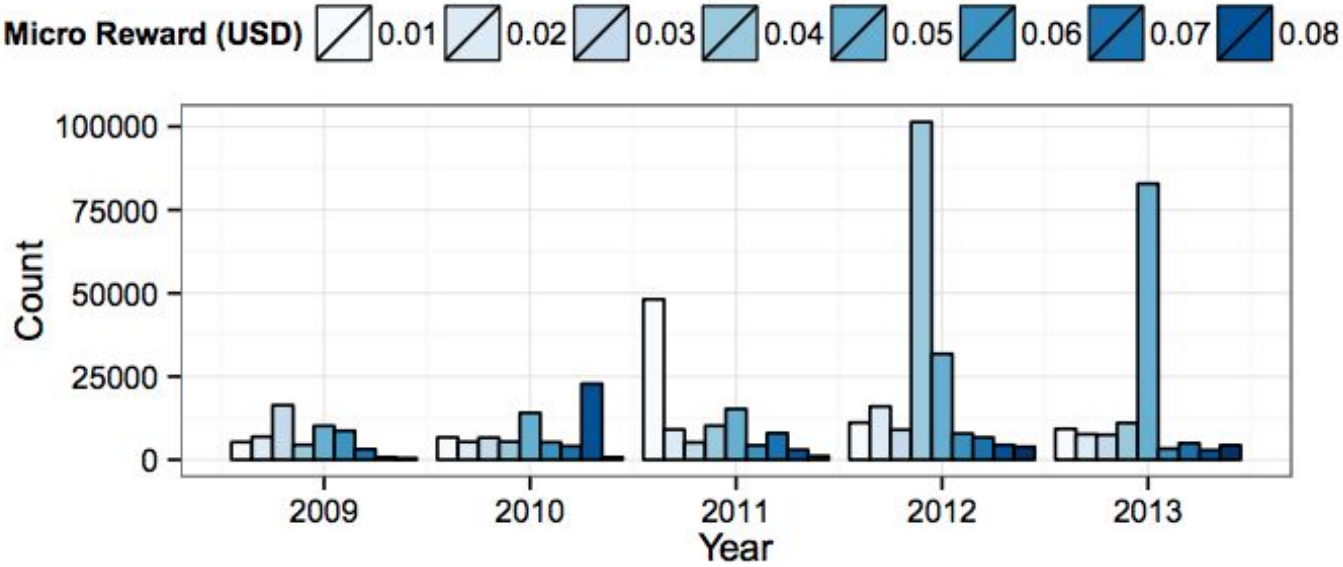
Setting Project Properties

- Microtask duration time:
  - Try to solve a HIT (including reading the instructions and examples)
- Redundancy:
  - Typically between 3 and 5, depending on the difficulty of the task
  - Can be increased on-the-fly (if needed) for some specific tasks
- Rewards:
  - Besides the basic payment, microtask platforms allow for rewarding bonuses to workers who completed additional work

Setting Project Properties: Payments

- Price commensurate with task effort
  - Example: $0.02 for yes/no answer + $0.02 **bonus** for optional feedback
- Ethics and market-factors
  - Consider the characteristics of the audience and the marketplace
- Uptake & time-to-completion vs. Cost & Quality
  - Low rewards: no crowd interest or slow answers
  - High rewards: may attract spammers
- Accuracy and quantity
  - More pay does not necessarily produce better answers [Mason and Watts, 2009]

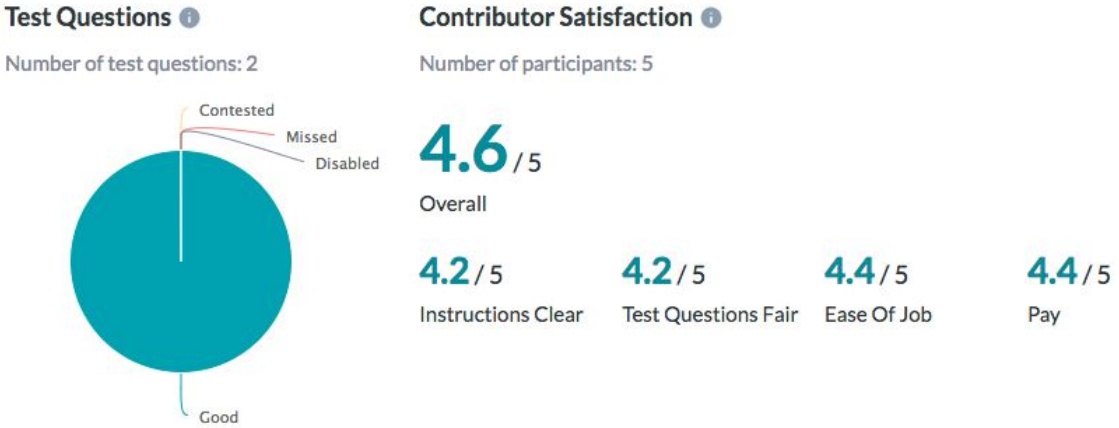
Payments:
Popularity of HIT Rewards in Amazon Mechanical Turk



Difallah, Catasta, Demartini, Ipeirotis, Cudré-Mauroux. *The Dynamics of Micro-Task Crowdsourcing: The Case of Amazon MTurk.* In WWW, 2015.

Execute Sample

- Select a subset of your data
- Run a test of your project to make sure that the settings are fine
- Monitor workers' satisfaction and re-adjust settings (if necessary)
    - Example of workers' satisfaction in one of our tasks executed in Figure Eight.



Execute Project

- **Monitor** the execution of the project
  - Take into consideration the workers' satisfaction and feedback
  - It could be that it is necessary to re-adjust the redundancy of some tasks in the project. This increases the overall cost of the project (check your budget)
- **Accept/reject** crowd answers:
  - In some platforms (e.g., MTurk) **the requester has full control** of accepting and paying for crowd answers/responses. In these cases, workers expect a fast reaction to their contributions
  - **In case of accepting a response:** the worker receives the pre-defined payment
  - **In case of rejecting a response:** the worker receives no payment. The requester may decide to re-submit this microtask to collect an answer from another worker

Collect Data

- Crowd answers are available as soon as they are ready and can be retrieved as: a **CSV file** or **data stream** (using the platform's API)
- The data collected from the microtask platform may include:
  - Timestamps when the task was created and when each crowd answer was submitted
  - Further metadata about the workers (worker ID, country, IP, confidence, total tasks solved)
- Some platforms allow for aggregating the data before retrieving the data:
  - Data can be aggregated by answer field
  - Typical aggregators: majority voting, average (in case of numbers)

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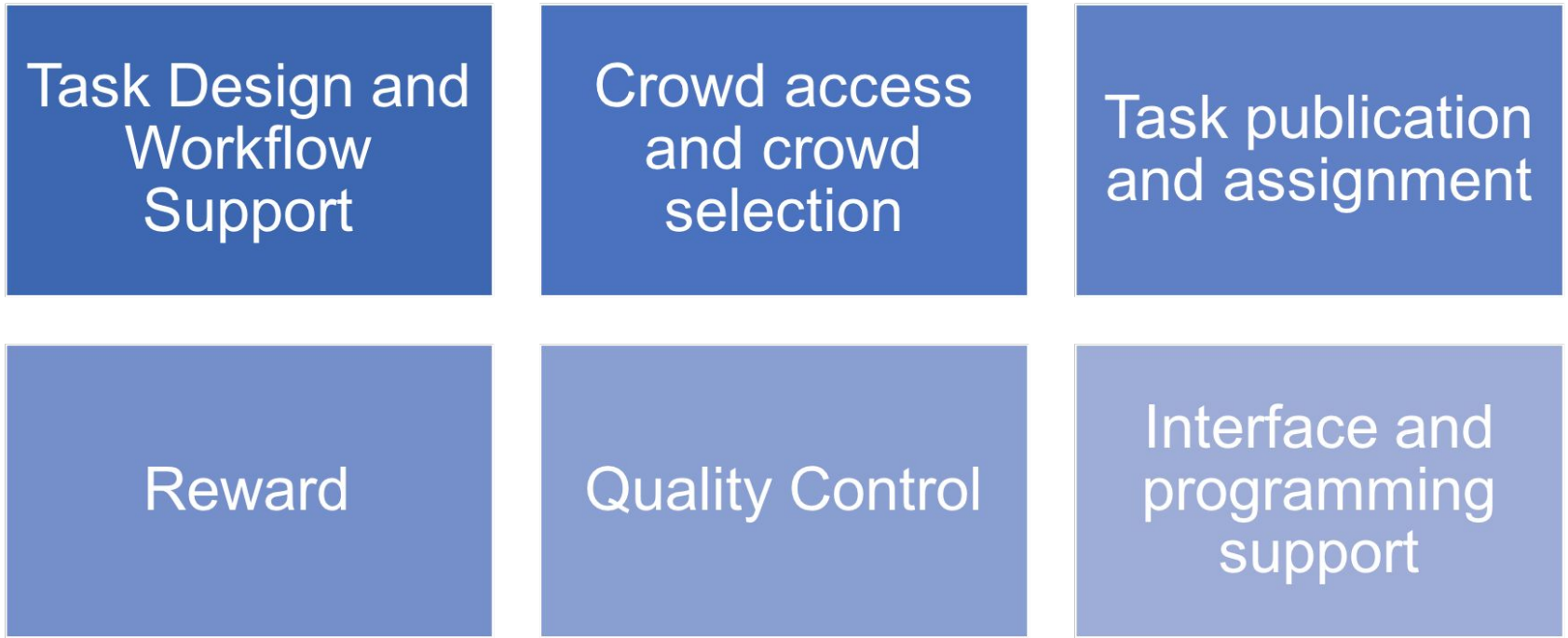
Components of Microtask Platforms



Amazon Mechanical Turk (MTurk)

https://www.mturk.com/

Information Gathering

The diversification and the scale of the MTurk workforce allows you to gather a breadth of information that would be almost impossible to do otherwise such as:

Allowing people to ask questions from a computer or mobile device about any topic and have Workers return the results

Filling out market research or survey data on a variety of topics

Writing content for websites

Finding specific fields or data elements in large legal and government documents

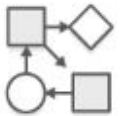
Data Processing

Companies take advantage of the power of the MTurk workforce to understand and intelligently respond to different types of data including:

Audio editing and transcription

Human powered translation services

Rating the accuracy of results for a search engine



Categorizing information to match a given schema or taxonomy

Amazon Mechanical Turk (MTurk)

https://www.mturk.com/

Image/Video Processing

MTurk is well-suited for processing images. While difficult for computers, it is a task that is extremely easy for people to do. In the past, companies have used MTurk to:

Tag objects found in an image to improve your search or advertising targeting

Review a set of images to select the best picture to represent a product

Audit user-uploaded images or videos to moderate content

Classify objects found in satellite imagery

Data Verification and Clean-up

ompanies with large online directories or catalogs are using MTurk to identify duplicate entries and verify item details. Examples of this have included:

Removing duplicate content from business listings

Identifying incomplete or duplicate product listings in a catalog

Verifying restaurant details such as phone numbers or hours of operation

Converting unstructured data about locations into well-formed addresses

Amazon Mechanical Turk (MTurk)

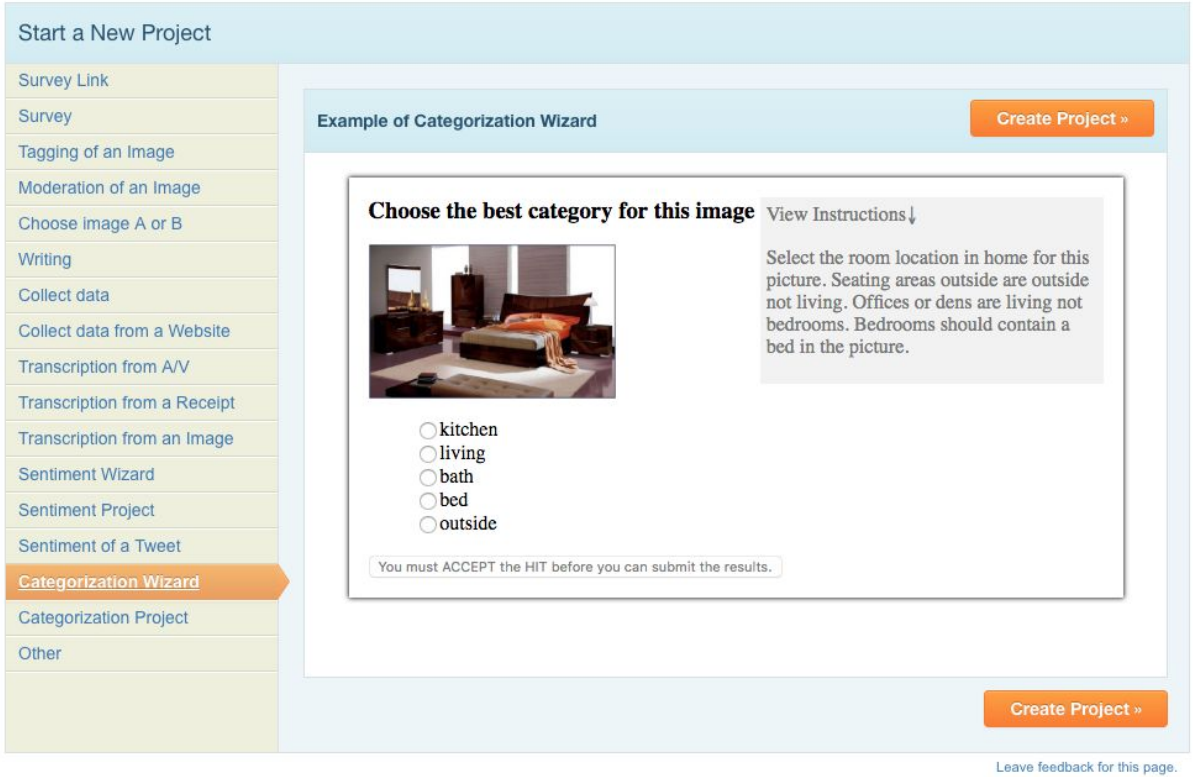


Figure Eight (Former CrowdFlower)

https://www.figure-eight.com/

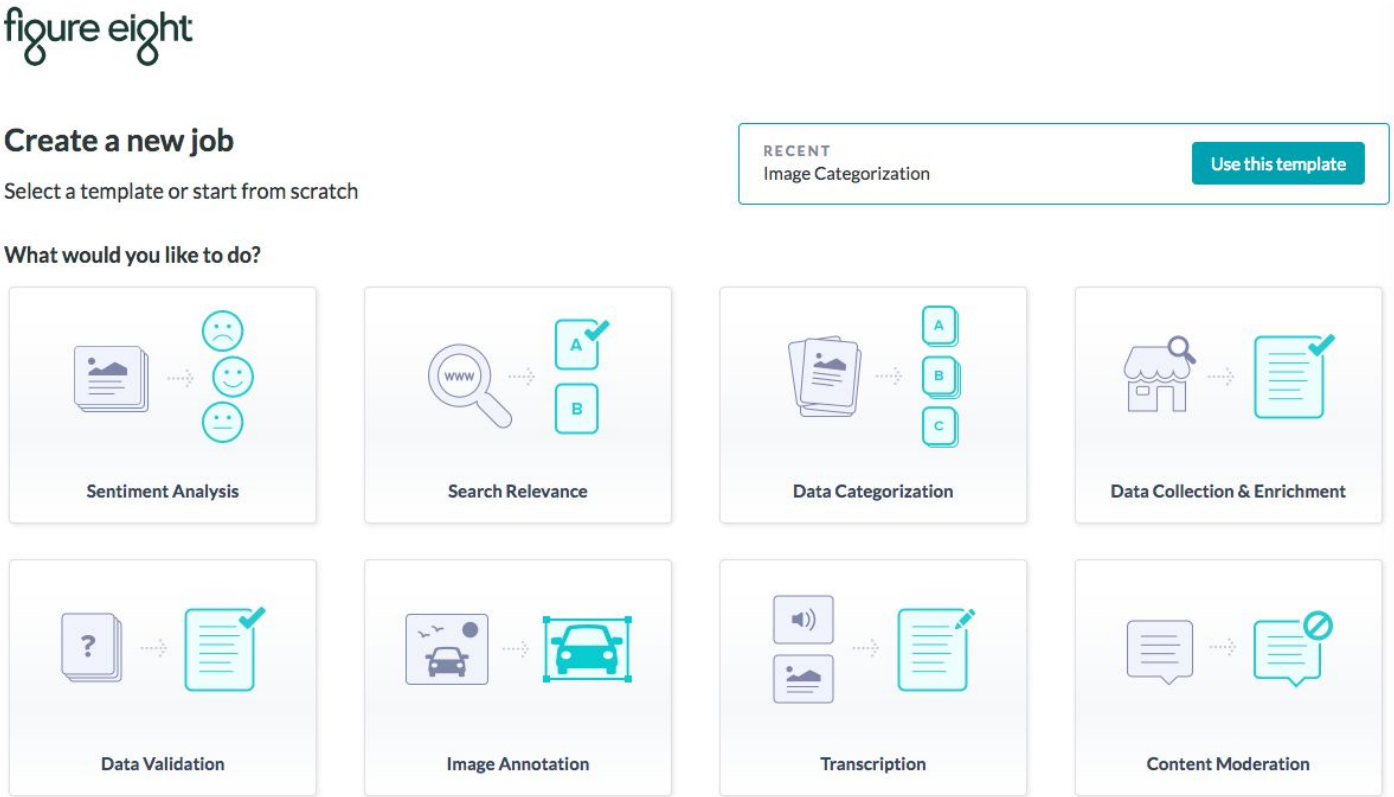
We transform messy, real world data into the training data powering AI

Over 100 million images labeled

Over 10 billion human judgments

Over 10 years enabling AI projects

Figure Eight (Former CrowdFlower)



Comparison: MTurk vs. Figure Eight

Criterion	**MTurk**	**Figure Eight**
Target tasks	Any	Focus on generation of training data for Machine Learning. But any type of task can be submitted
Crowd access	Own pool of workers	Reach to other microtask platforms (channels) to recruit workers
Sandbox support	Yes	No
Quality control	Quality control is responsibility of the requester	The platform filters out spammer or low-quality answers
Features	Basic task interfaces	Support advanced interface language including figure annotation
Fee	A percentage of the task payment	In general, higher than MTurk

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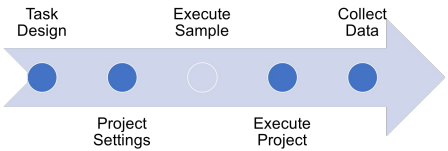
Summary

- Microtask dimensions: **What** (problem), **Who** (crowd), **How** (task)
- Microtask terminology: requester, worker, HIT, assignment/judgment, reward
- Typical workflow for executing microtasks:



Prepare to iterate!

- Microtask Platforms:
  - MTurk vs. Figure Eight
  - They differ in microtask workflow, worker pool, fees

References

- MTurk: Concepts
  http://docs.aws.amazon.com/AWSMechTurk/latest/RequesterUI/mechanical-turk-concepts.html
- Figure Eight: Glossary of Terms
  https://success.crowdflower.com/hc/en-us/articles/202703305-Getting-Started-Glossary-of-Terms
- The Mechanical Turk Blog
  https://blog.mturk.com
- Tips For Requesters On Mechanical Turk
  http://turkrequesters.blogspot.co.uk/
- Requester Best Practices Guide
  http://mturkpublic.s3.amazonaws.com/docs/MTURK_BP.pdf

Final Remarks

- Main assumption for applying microtask crowdsourcing:
  the problem can be **divided** into microtasks

- Exploiting the right **incentives** for increasing the quality of crowd answers:
  - Monetary rewards are not the only incentives for the crowd
  - Altruism and fun can be other incentives in microtask crowdsourcing

- Combining **machine-human solutions** produce high quality results

- Consider **ethical conditions**: we are working with **people**

Hands-on I: Designing a Task on Figure Eight (CrowdFlower)

https://www.figure-eight.com/

Acknowledgements

Slides adapted from the tutorial “Microtask Crowdsourcing to Solve Semantic Web Problems” by Gianluca Demartini, Elena Simperl, and Maribel Acosta at ISWC 2013.
Source: https://github.com/maribelacosta/crowdsourcing-tutorial