

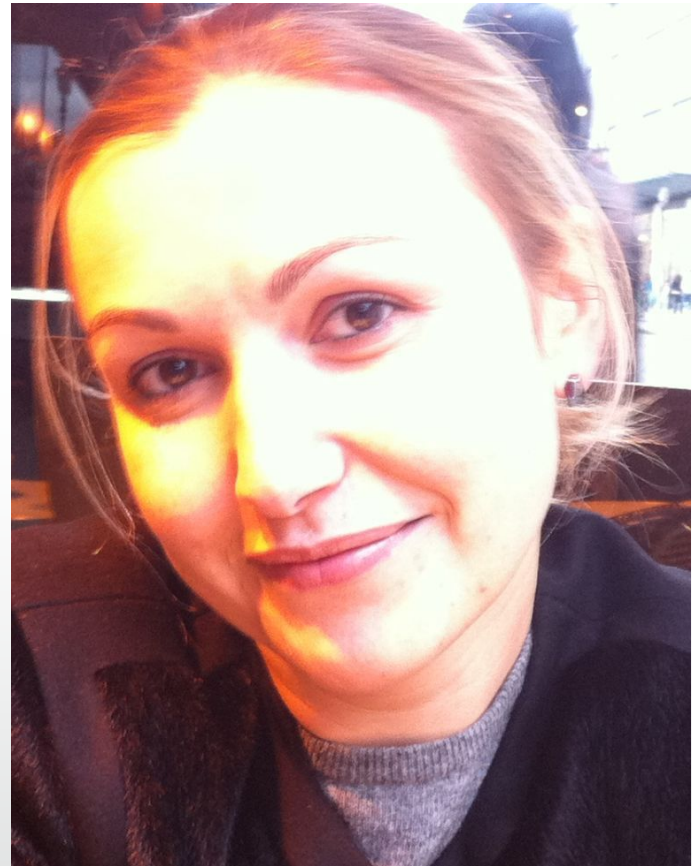
Fundamentals of crowdsourcing

@COMP6037

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20 November 2013

About me

- PhD in Computer Science FU Berlin, Germany (2007)
- Worked for FU Berlin, Germany; STI Innsbruck, Austria; KIT, Germany
- Senior lecturer, Web and Internet Science group (since 11/2012)
- Research interests
 - Social computing
 - Crowdsourcing
 - Semantic technologies and Linked Data
 - Open data
 - User-centered design



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Crowdsourcing: problem solving via open calls

"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."

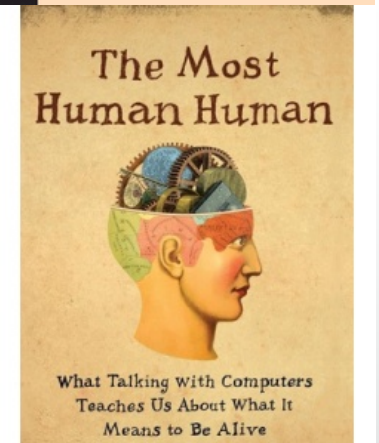
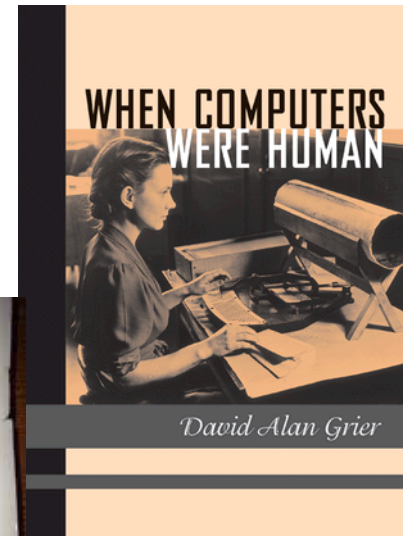
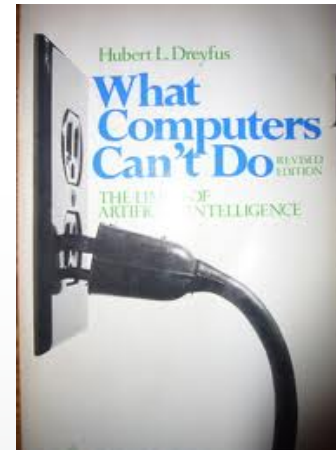
[Howe, 2006]



In this lecture:

Crowdsourcing as human computation

- Outsourcing tasks that machines find difficult to solve to humans
 - Difficult not the same as impossible
 - Accuracy, efficiency, cost
- Historically humans were the first computers
 - 17th century: Halley's comet
 - 19th century: computing factories
 - 20th century: professionalization of human computation
 - *Characteristics: division of labor, redundancy, multiple methods to find or check the correctness of a solution*



Examples

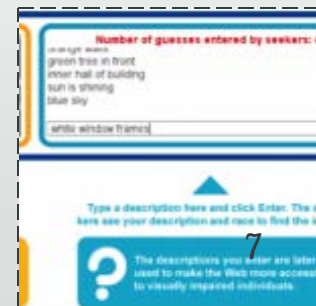
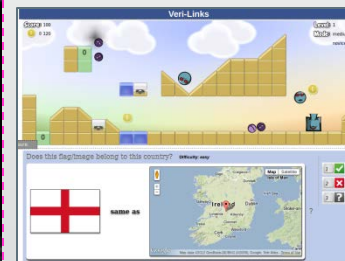
The Web played a key role in the uptake of crowdsourcing



Games with a purpose (GWAP)

- Human computation disguised as casual games
- Tasks are divided into parallelizable atomic units (challenges) solved (consensually) by players
- Game models
 - Single vs. multi-player
 - Selection agreement vs. input agreement vs. inversion-problem games

See also [van Ahn & Dabbish, 2008]



Paid microtask crowdsourcing

- Similar types of tasks, but different incentives model (monetary reward)
- Successfully applied to transcription, classification, and content generation, data collection, image tagging, website feedback, usability tests

Make Money by working on HITs

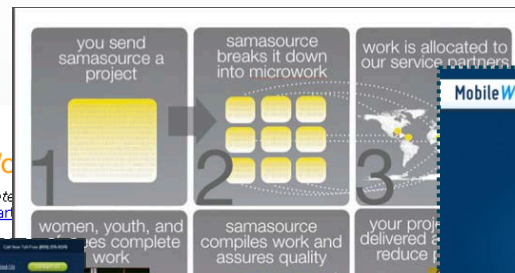
HITs - *Human Intelligence Tasks* - are individual tasks that you work on. [Find HITs now.](#)

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. [Get started](#)



Dimensions of human computation

What is outsourced

- Tasks based on human skills not easily replicable by machines (visual recognition, language understanding, knowledge acquisition, basic human communication etc)

Who is the crowd

- Open call
- Call may target specific skills and expertise
- Requester typically knows less about the workers than in other work environments

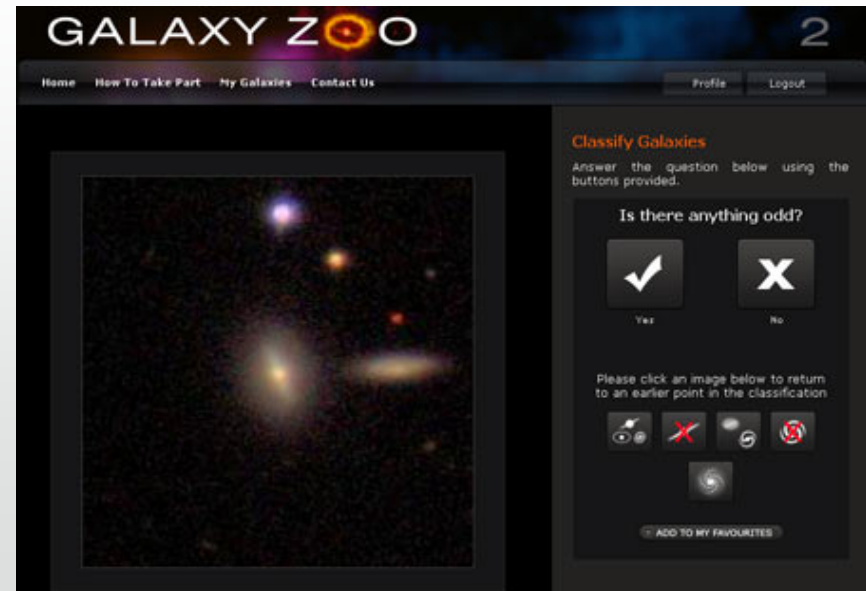
How is the task outsourced

- 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

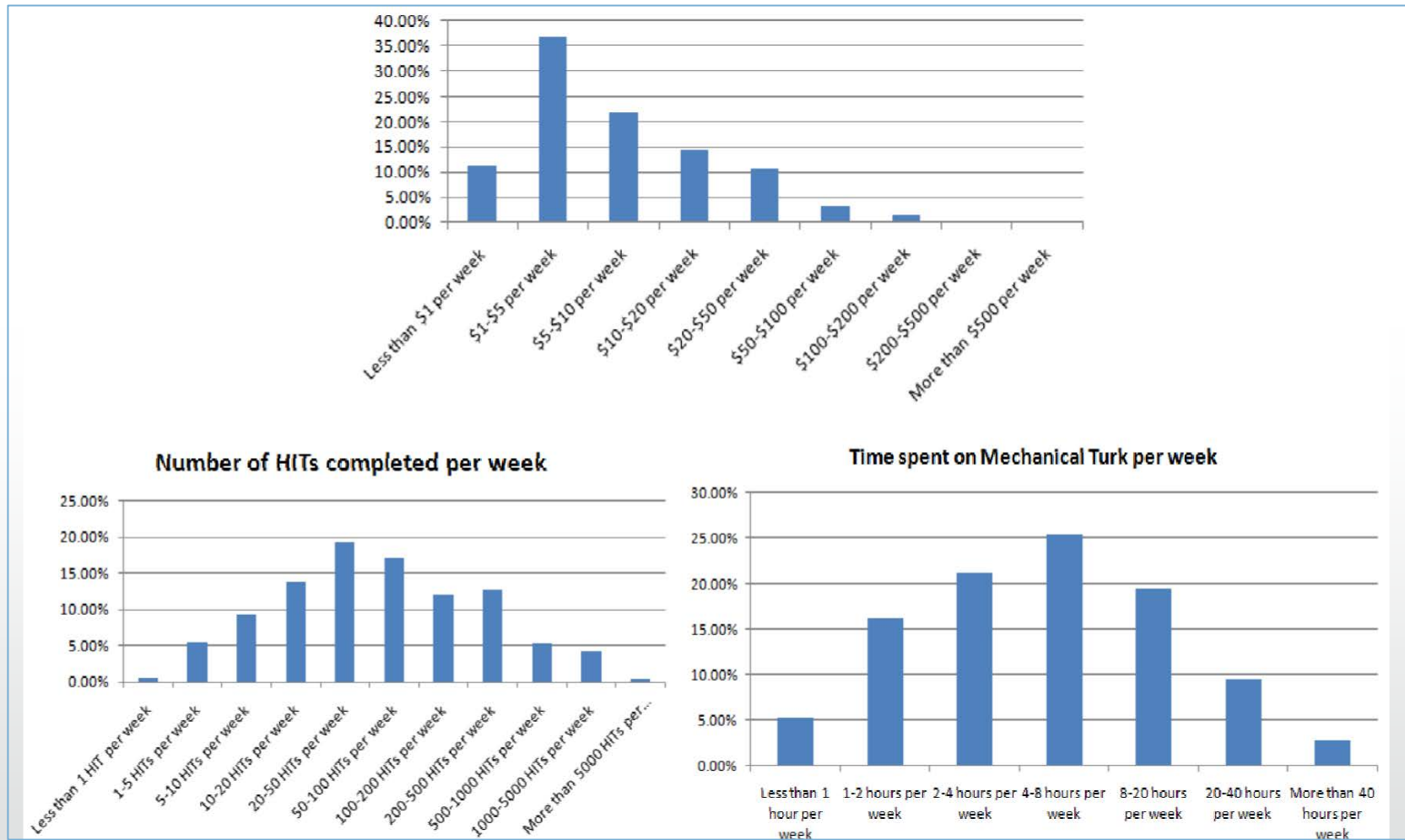
See also [Quinn & Bederson, 2012]

Example: citizen science via human computation

- **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



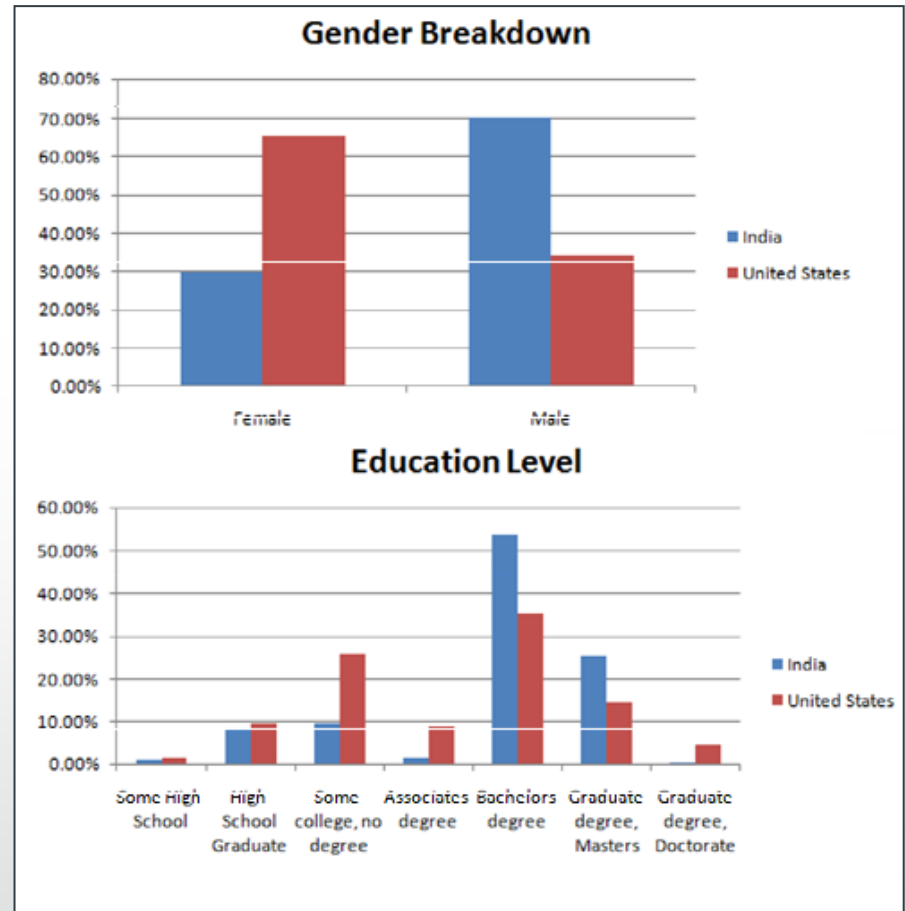
60% of workers spend more than 4 hours a week on MTurk



A large, but not always diverse crowd

Country of residence

- United States: 46.80%
- India: 34.00%
- Miscellaneous: 19.20%



Significant resources and timely delivery



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

Complex workflows cannot always be directly implemented

What is outsourced

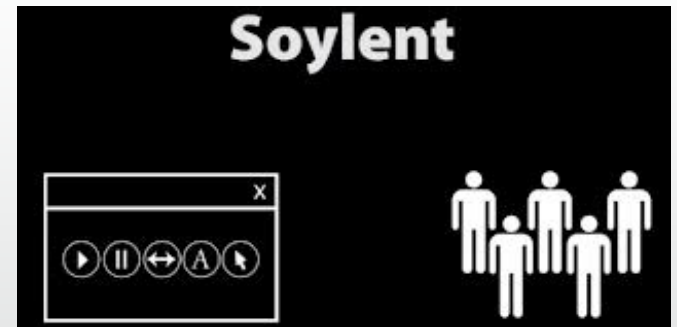
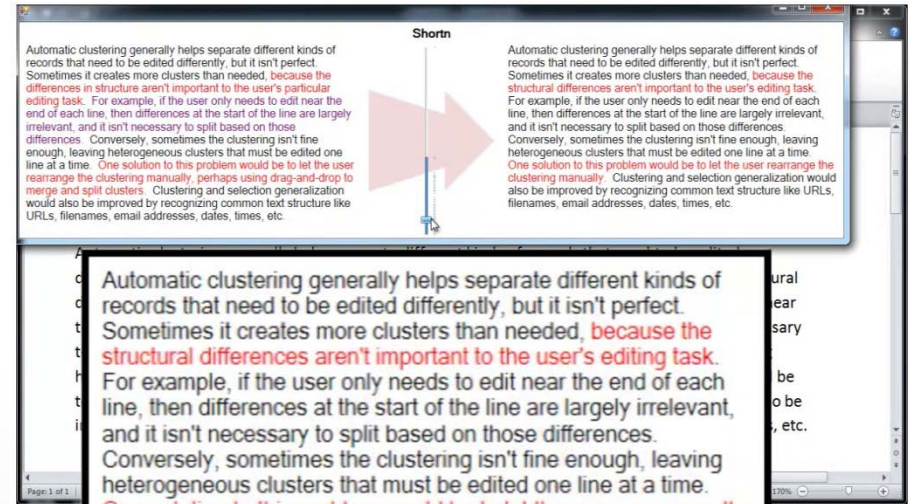
- Text shortening, proof-reading, open editing

Who is the crowd

- MTurk

How is the task outsourced

- Text divided into paragraphs
- Select-fix-verify pattern
- Multiple workers in each step



http://www.youtube.com/watch?v=n_miZqsPwsc

See also [Bernstein et al., 2010]

Dimensions of human computation (2)

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]

Quality assessment 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
- Near-real-time microtasks, see Bernstein et al. *Crowds in Two Seconds: Enabling Realtime Crowd-Powered Interfaces*. In Proc. UIST 2011.

Example Categorization Questions

What type of business is this?

Bank of America

- Financial Institute
- Retailer
- Restaurant
- Other

Does this blog o
our guidelines?

"No way! You're
think that!"

- Yes
- No

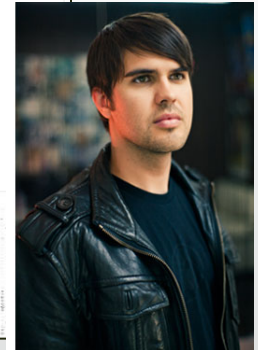
Upcoming Credentialed Work

Last Updated: May 16, 2013 11:07AM PST

| Start Date | Brief Description | Required Credential | Number | |
|--------------------|-----------------------------------------------------|---------------------|------------------------------|--------------------|
| Current (on-going) | 150 to 300-word Small Business Product Descriptions | Marketing Writer 2 | 100+ Re | |
| Current (on-going) | 475-word Reply! Articles | General Writer 1 | 400+ Re | |
| Current (on-going) | 65 to 75-word Medical Specialty Blurbs | General Writer 2 | 4000+ | |
| Current (on-going) | 500- to 750-word movie reviews and analyses. | General Writer 1 | 36/week | |
| Current (on-going) | 450-word Small Business Blog Articles | Marketing Writer 2 | 40/month | 5 Cents (Per Word) |
| Current (on-going) | 300-word Marketing Content. | General Writer 1 | 100+ | |
| Current (test-run) | Costume/Accessory PDs. | Marketing Writer 1 | 300 remaining | |
| Current (on-going) | Short Leadins. | General Writer 1 | 500/week | 3 Cents (Per Word) |
| Current (on-going) | PPQAs | General Writer 1 | 20,000 (late May/early June) | 3 Cents (Per Word) |
| Current (on-going) | Visa Print PDs | Marketing Writer 1 | 5000 Remaining | 3 Cents (Per Word) |

THE SHEEP MARKET

30,000 sheep created
by online workers.
Here...



http://www.ted.com/talks/aaron_koblin.html

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.

altruism
reputation
freedom reciprocity
self-expression
competition
community
autonomy
fun

Combining human and computational intelligence

Example: data integration

| paper | conf |
|------------------|-------------|
| Data integration | VLDB-01 |
| Data mining | SIGMOD-02 |

| title | author | email | venue |
|--------------|---------------|--------------|--------------|
| OLAP | Mike | mike@a | ICDE-02 |
| Social media | Jane | jane@b | PODS-05 |

Generate plausible matches

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

Ask users to verify

Does attribute **paper** match attribute **author**?

| paper | conf |
|------------------|-------------|
| Data integration | VLDB-01 |
| Data mining | SIGMOD-02 |

| title | author | email |
|--------------|---------------|--------------|
| OLAP | Mike | mike@a |
| Social media | Jane | jane@b |

Yes

No

Not sure

See also [McCann, Shen, Doan, 2008]

Some research challenges

- Design principles and guidelines
- Systems combining different paradigms
- Integration of human and computational intelligence
- Complex workflow support
- Quality assurance, speed, task assignment
- Data-driven optimizations using log data
 - Social network analysis
 - User profiling
 - Content analysis
- Applications to new settings (e.g., enterprise)