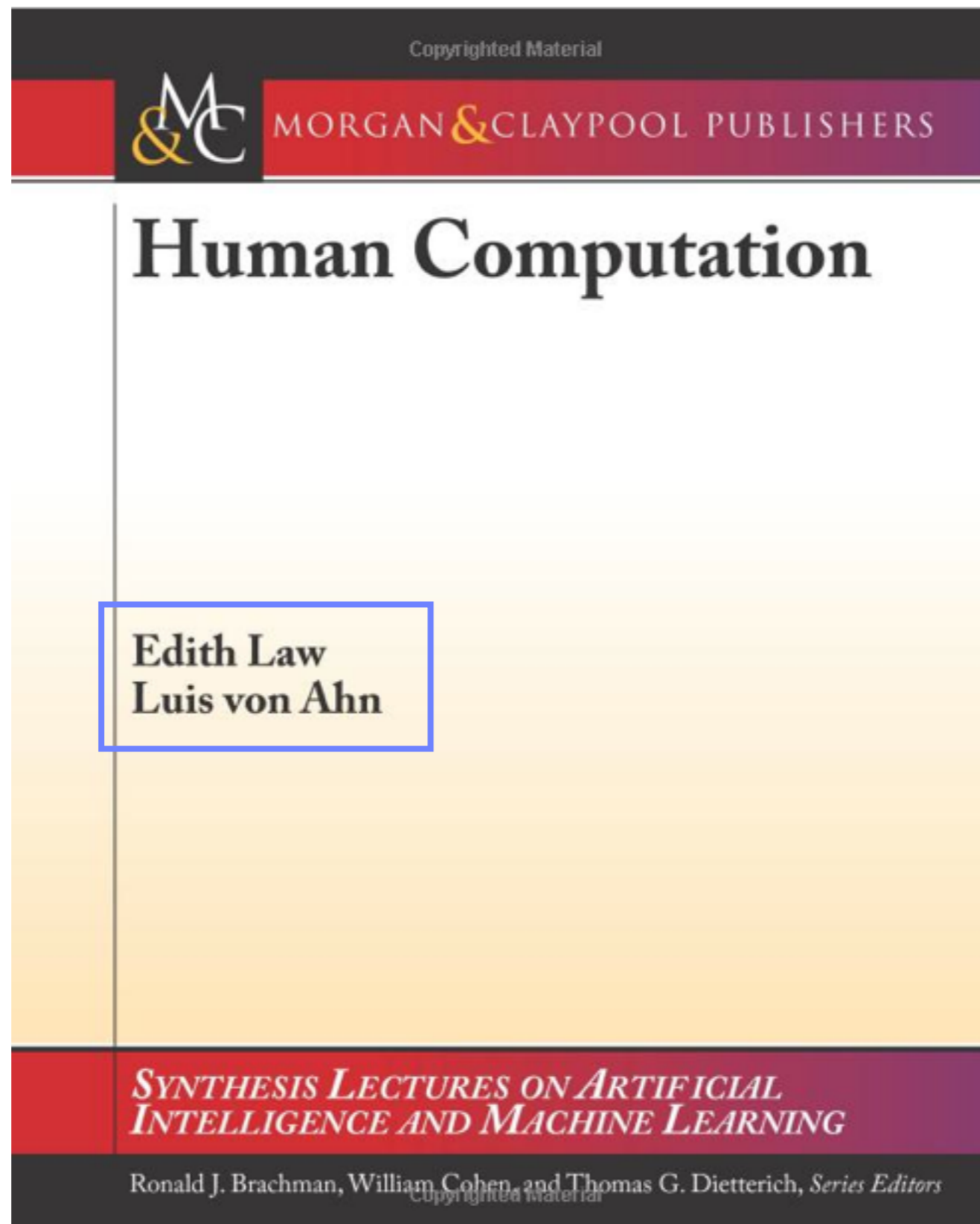


Human Computation



参考书



参考书章节

- *Introduction*
- *Human Computation Algorithms*
- *Aggregating Outputs*
- *Task Routing*
- *Understanding Workers and Requesters*
- *The Arts of Asking Questions*
- *Conclusions*

旗舰会议

HCOMP 2017

The fifth AAAI Conference on Human Computation and Crowdsourcing

📅 October 24-26, 2017 📍 Quebec City, Canada

主要内容

- *Human Computation* 概念
- *Human Computation* 算法
- *Human Computation* 例子

Human Computation概念

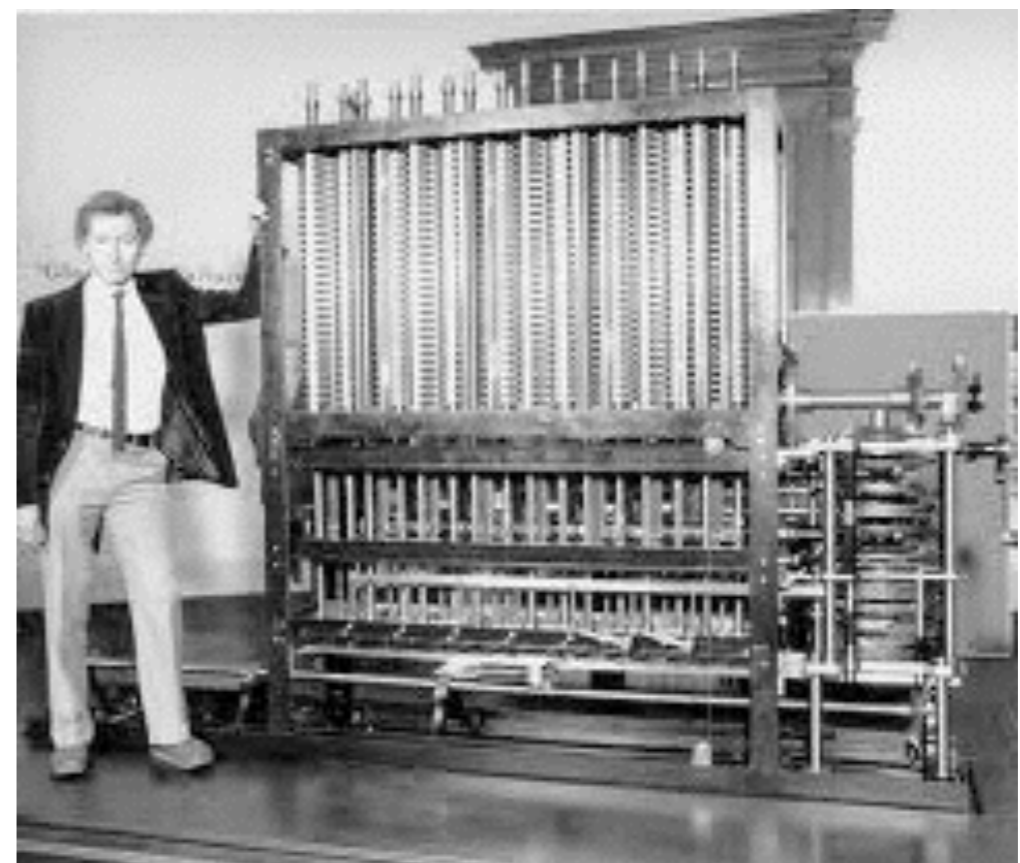
Computation历史



计算公式 → 任务分解



操作指南 → 结果合并



Human Computation

- 计算

 - ✳ 使用算法映射输入到输出的过程

- Human Computation

 - ✳ 人来执行的计算

2005



人工智能难题

思考

现在有哪些Human Computation应用?

Human Computation产生需要什么基础?

人工智能难题

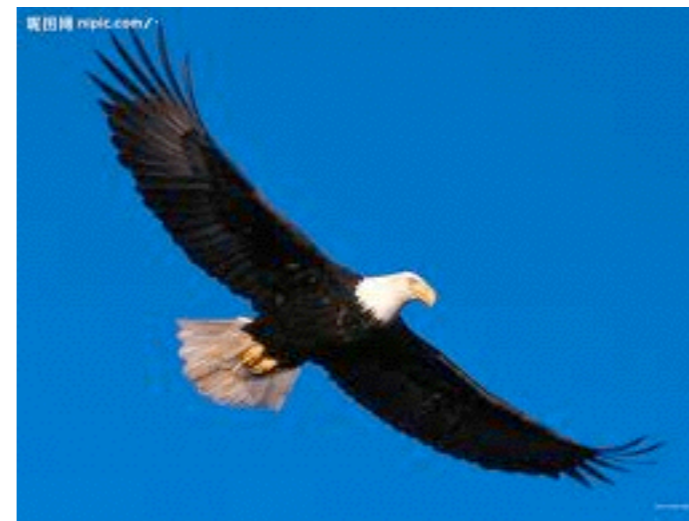
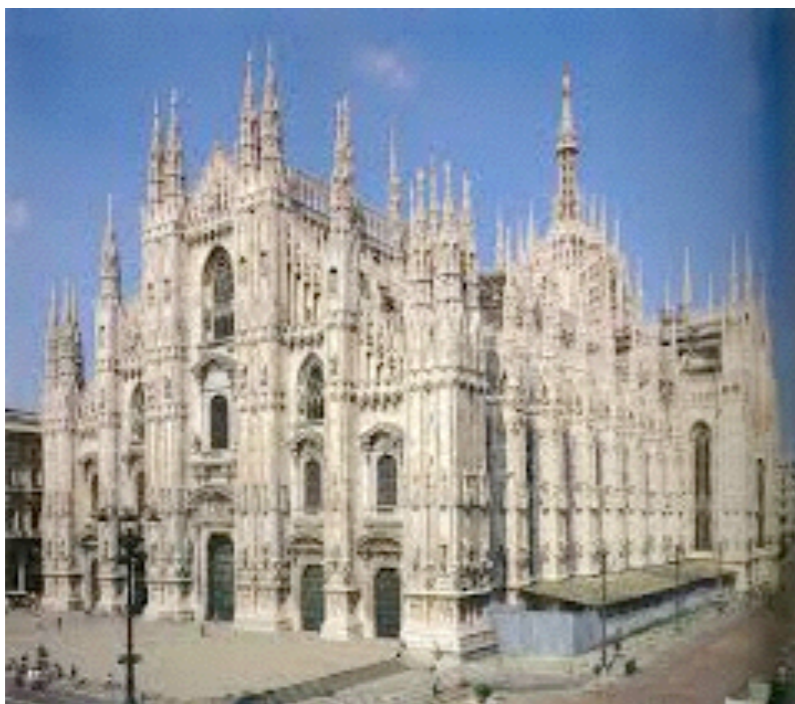
- 现在依然存在许多人工智能难题
 - ✳ 人很容易解决
 - ✳ 但是复杂的计算机算法很难解决
- 常见的人工智能难题
 - ✳ 感知（目标识别、分类）
 - ✳ 自然语言分析（观点分析、翻译）
 - ✳ 认知（计划、推理）

人工智能难题 - OCR

The Breckinridge and Lane Democrats, having taken courage at the recent eastern advices, are organizing energetically for the campaign. Several prominent Democrats who at first favored DOUGLAS, are coming out for the other side, apparently under the pressure of Federal influence. An address to the National Democracy of California, urging the party to support BRECKINRIDGE, has recently been published, which manifestly has strengthened that side of the question. It is signed by 65 Democrats, many of whom occupy respectable and prominent positions in the party, 22 of them are Federal office-holders, eight more are recipients of Federal patronage, and the others represent a mass of politicians giving the document most weight. The Douglas Democrats are also active. The Irish and German vote will mostly go with that branch of the party, but it is difficult to estimate which wing is the stronger. Thus far 17 Democratic newspapers have declared for DOUGLAS, 13 for BRECKINRIDGE, and 9 remain non-committal, with even chances of going either way. Under these circumstances the Republicans entertain not unjustifiable hopes that the Democratic divisions may be so equally balanced as to give the State to LINCOLN. Some very respectable Bell and Everett meetings have been held in different parts of the State, but thus far that party does not exhibit much rank and file strength.

The New-York State Yacht Squadron, on its annual cruise to Newport, came into the harbor yesterday afternoon. The following are the names of the boats that came to anchor here: *Jessie*, *Geraldine*, *Evelyn*, *Annie*, *Mannering*, *Julia*, *Bonita*, *Magie*, *Widgou*, *Rambler*, *Fleur-de-Lis*, *Henrietta*, *Sea-Drift* and *Maria*, with the steamer *America* as a tender. On anchoring, each boat fired a gun, according to custom. The reports were heard distinctly in the city, causing considerable inquiry as to "what was up," and quite a number of sanguine individuals came into our office to inquire if the guns were not annunciatory signals of the successful laying of the Atlantic Cable. We invariably replied in the negative. The squadron will leave to-day for Newport. The yachts *Washington* and *Ratler*, of this city, start with it, with parties of New-Haven people.

人工智能难题 - 图像识别



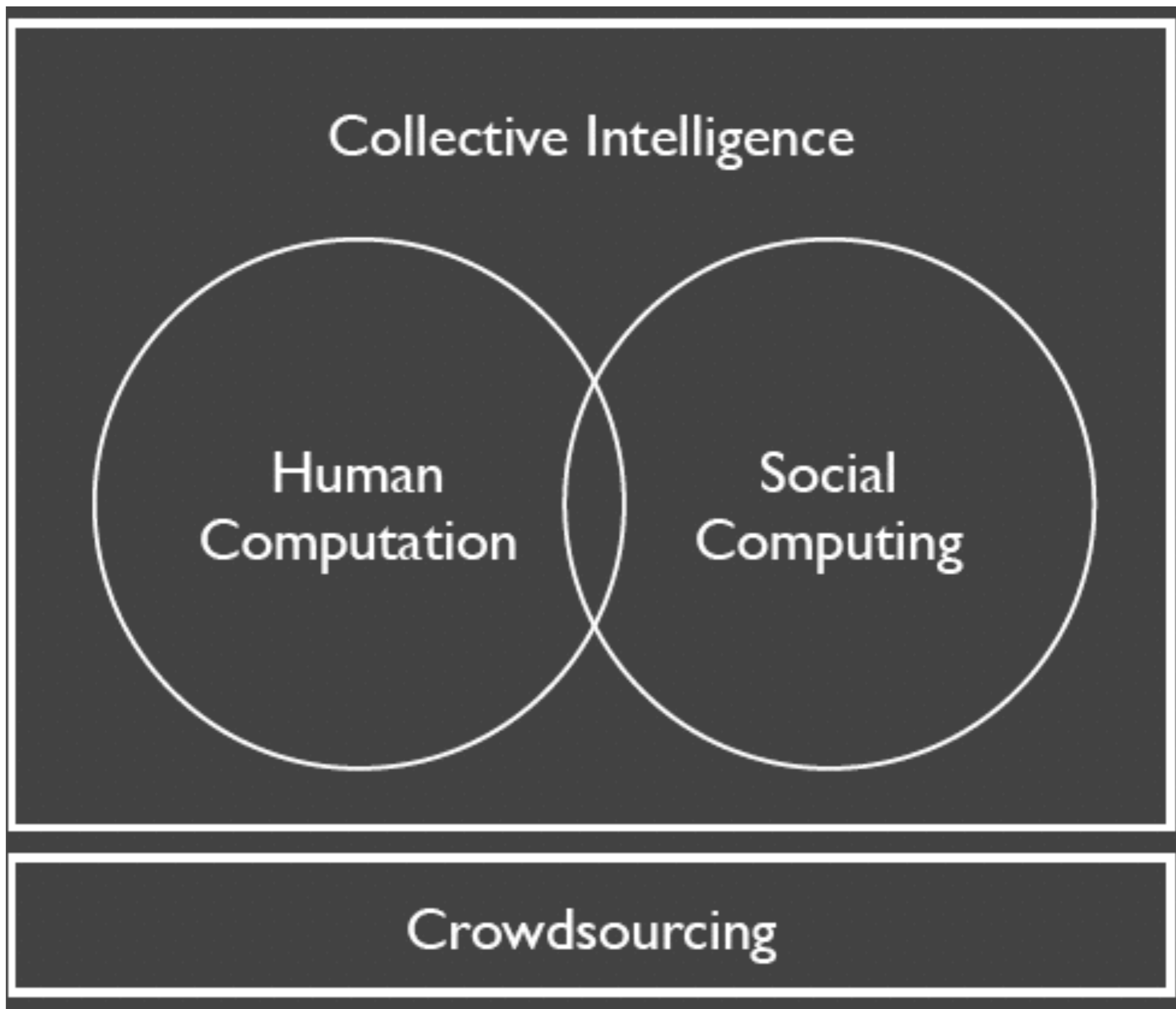
Tag系统 **Q&A系统**

相关概念

动物
机器

社会
行为

工具
方法



群体
智能

社会
计算

众包

三个层面

decide what operations need to be performed in what order

Algorithm

WHAT

Explicit Control

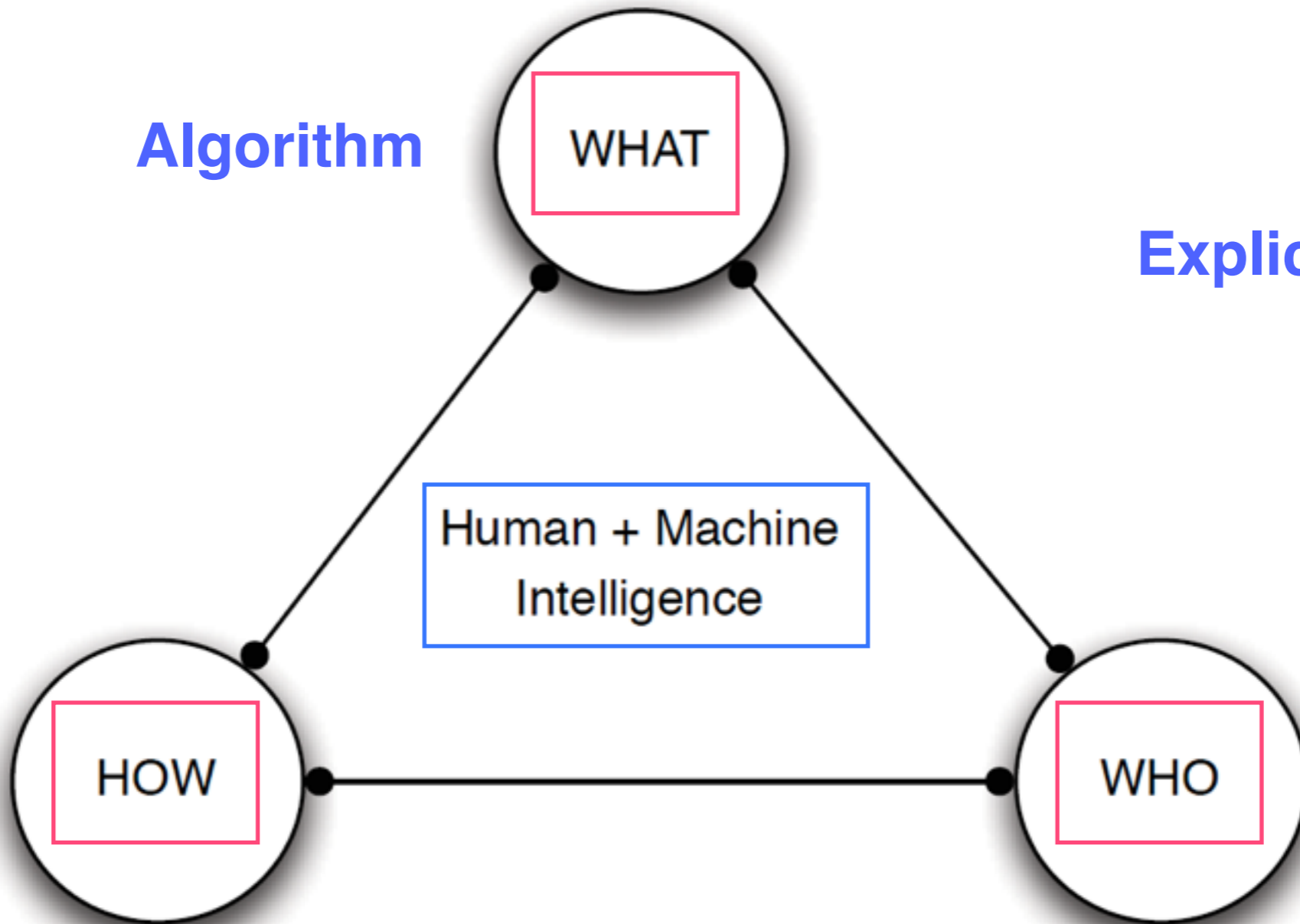
Human + Machine
Intelligence

HOW

WHO

decide how each operation is to be performed

decide to whom each operation should be assigned



AI难题

- 识别：图像识别、语音识别, ...
- 语言：NLP、翻译, ...
- 计算密集问题：象棋、围棋、NP问题、生物学基因测序, ...
- 自愿计算：SETI@Home, ...
- 其余：医疗诊断、文本编辑、计划...

Human Computation 算法

算法

Inputs



```
function quicksort(A)
  initialize empty lists L and G
  if (length(A) ≤ 1)
    return A
  pivot = A.remove(find_pivot(A));
  for x in A
    if compare(x, pivot)
      L.add(x)
    else
      G.add(x)
  return concatenate(quicksort(L), pivot, quicksort(G))

function pivot(A)
  return randomIndex(A);

function compare(x, pivot)
  return (x < pivot)
```

Termination
Condition



Outputs



Sufficiently
Basic



Operations



Precisely
Defined
Steps



人计算

```
function quicksort(A)
  initialize empty lists L and G
  if (length(A) ≤ 1)
    return A
  pivot = A.remove(find_pivot(A));
  for x in A
    if compare(x, pivot)
      L.add(x)
    else
      G.add(x)
  return concatenate(quicksort(L), pivot, quicksort(G))

function pivot(A)
  return randomIndex(A);

function compare(x, pivot)
  return human_compare(x, pivot)
```

Mechanical Turk Task

[Instructions](#)

You are shown two images. You must select the image that is more indicative of suspicious activities.

Task

Imagine that you are a security guard and you are monitoring two places. Someone informed you that there are suspicious activities in one of the places, but you were not told which one. Which place will you attend to?



Submit



人计算

```
function quicksort(A)
  initialize empty lists L and G
  if (length(A) ≤ 1)
    return A
  pivot = A.remove(find_pivot(A));
  for x in A
    if compare(x, pivot)
      L.add(x)
    else
      G.add(x)
  return concatenate(quicksort(L), pivot, quicksort(G))

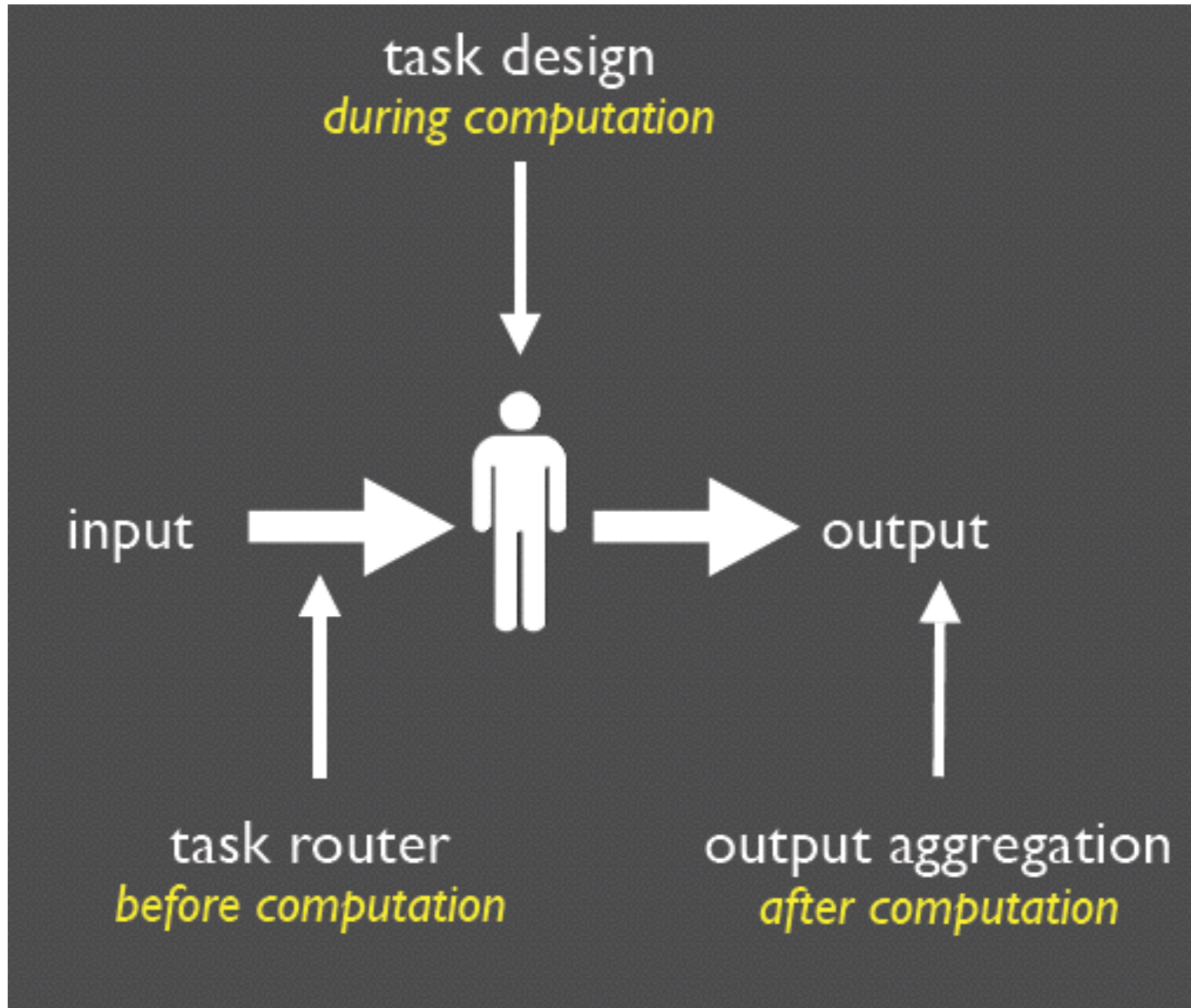
function pivot(A)
  return randomIndex(A);

function compare(x, pivot)
  return human_compare(x, pivot)
```

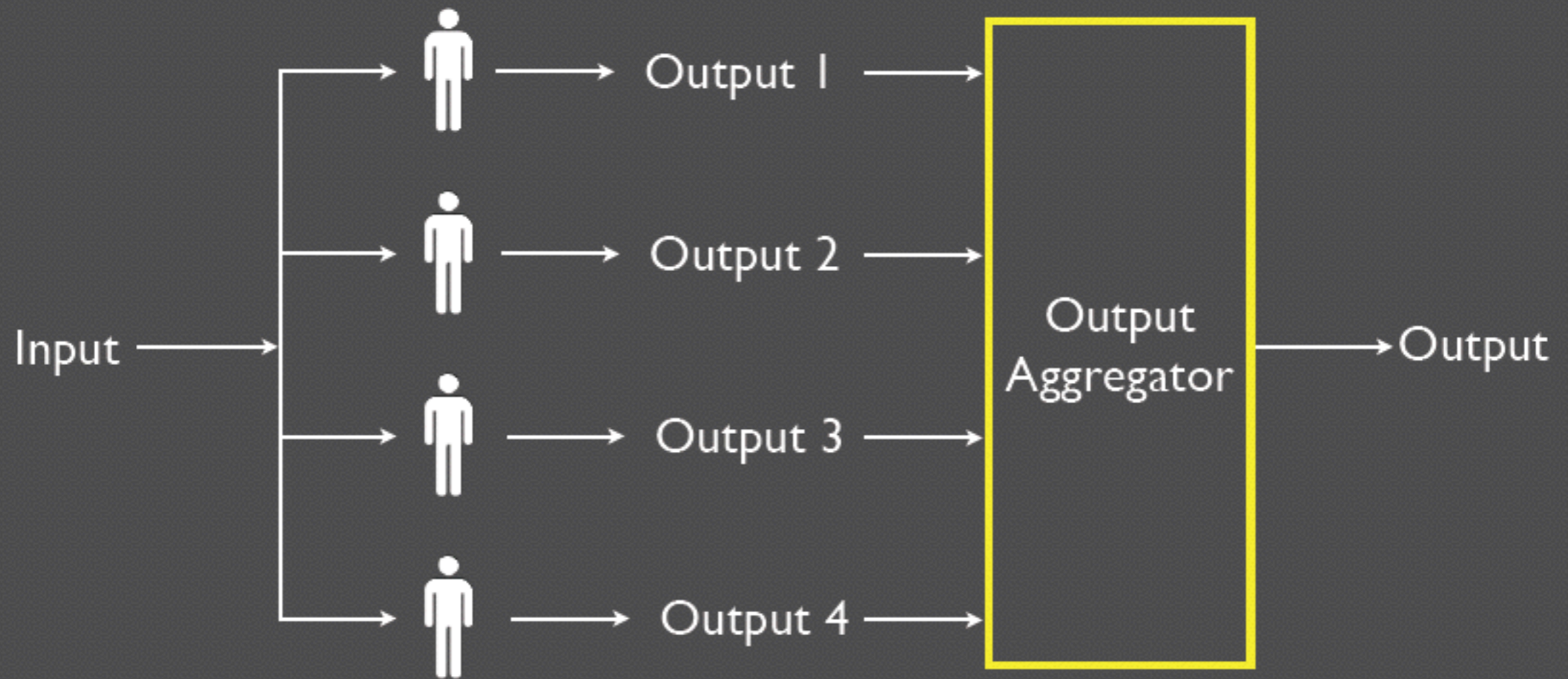
Games with a Purpose



算法正确性



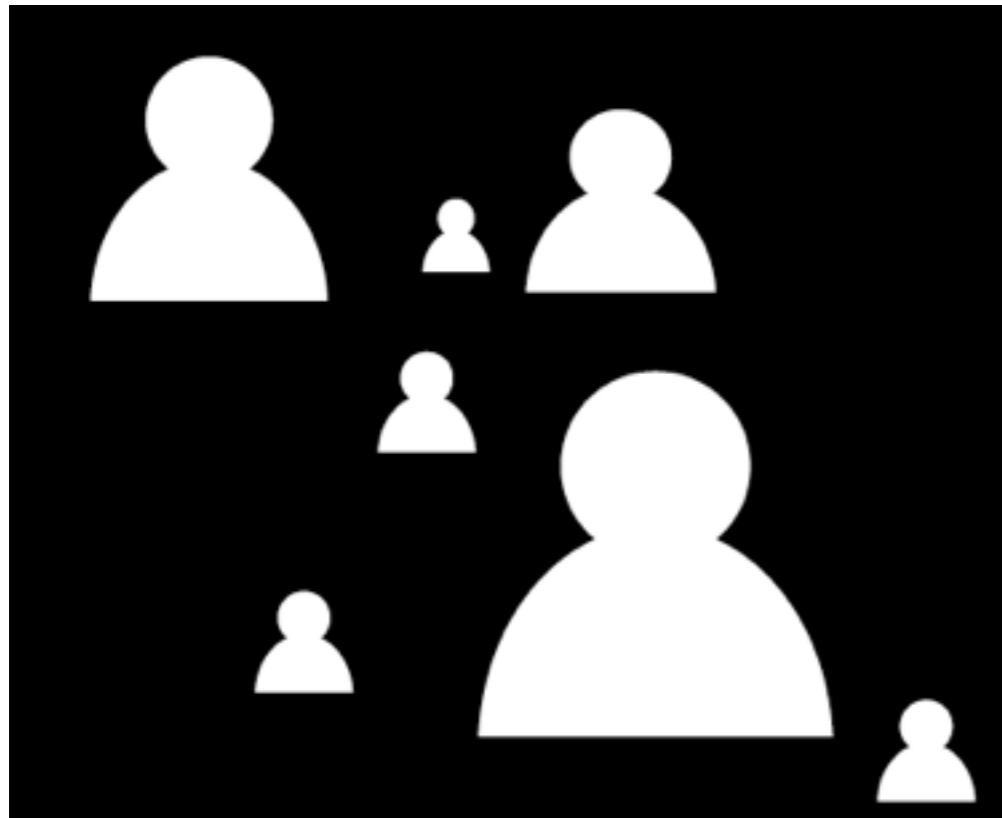
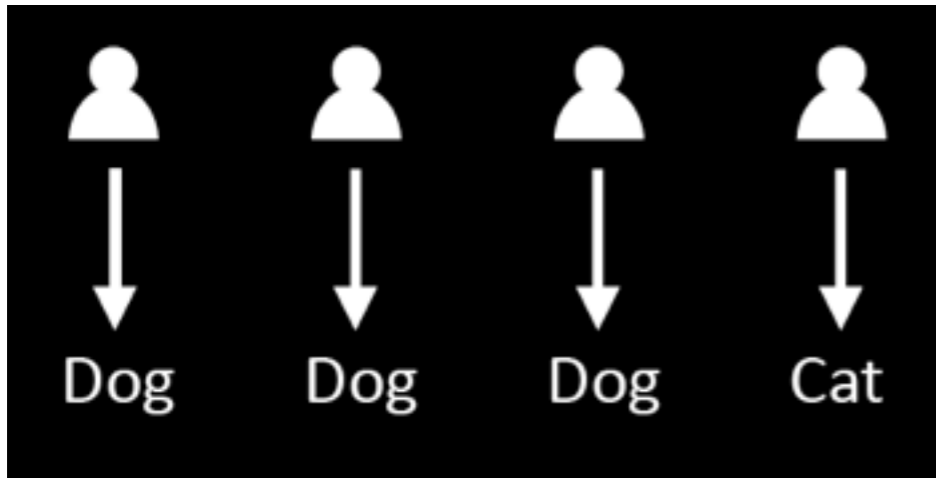
结果汇集



动机

- Money
- Access
- Game
- Volunteer
- Learning

正确性



The King himself directed the operations

The King himself directed the operations

The King himself directed the operations

The King himself directed the operations

The King lala the

himself the

Human Computation例子

ESP: Web图像识别

- Web上的图像识别是一个主要的技术挑战
- 大量图片存在，但是文本描述很少，自动识别很不准确
- 人来做标记是一个无奈的选择

游戏

- 每周现在有20亿用户玩在线游戏
- 21岁美国人万游戏时间，平均一生5年



ESP游戏

- 两个用户同时独立的标记一个图片
- 如果标记一致会得到奖励



Player 1 guesses: purse
Player 1 guesses: bag
Player 1 guesses: brown

Success! Agreement on "purse"



Player 2 guesses: handbag

Player 2 guesses: purse
Success! Agreement on "purse"

Citizen Science

- 科学是数据密集型的
 - ✳ 气候
 - ✳ 物种分布
 - ✳ 星体轨迹
- 科学家数量少
- 非科学家来收集和解释数据

Galaxy Zoo

Galaxy Zoo: Hubble

www.galaxyzoo.org

EN · Galaxy Zoo is a ZOO NIVERSE project ...just like MOON ZOO

GALAXY ZOO HUBBLE

Home The Story So Far How To Take Part Classify Galaxies Explore Galaxies The Science FAQ Forum Blog Contact Us

Pictures



You aren't logged in so we can't record your results!

Welcome to Galaxy Zoo, where you can help astronomers explore the Universe

Galaxy Zoo: Hubble uses gorgeous imagery of hundreds of thousands of galaxies drawn from NASA's Hubble Space Telescope archive. To understand how these galaxies, and our own, formed we need your help to classify them according to their shapes — a task at which your brain is better than even the most advanced computer. If you're quick, you may even be the first person in history to see each of the galaxies you're asked to classify.

More than 250,000 people have taken part in Galaxy Zoo so far, producing a wealth of valuable data and sending telescopes on Earth and in space

Classifier Log In

[Click here to log in](#)

- Register
- Forgotten Password?

Explore galaxies

Enter a search term

eBird

eBird News and Features — eBird

ebird.org/content/ebird/

eBird

Home | About eBird | Submit Observations | View and Explore Data | My eBird

[Sign In](#) | [Register as a New User](#) | Translate to: [English](#)

Oil Slick Forecast: Now 24 hr 48 hr 72 hr


Welcome to eBird

eBird is as birder does!

eBird News and Features

[eBirder of the Month -- Mary Gustafson](#)
November 12, 2011

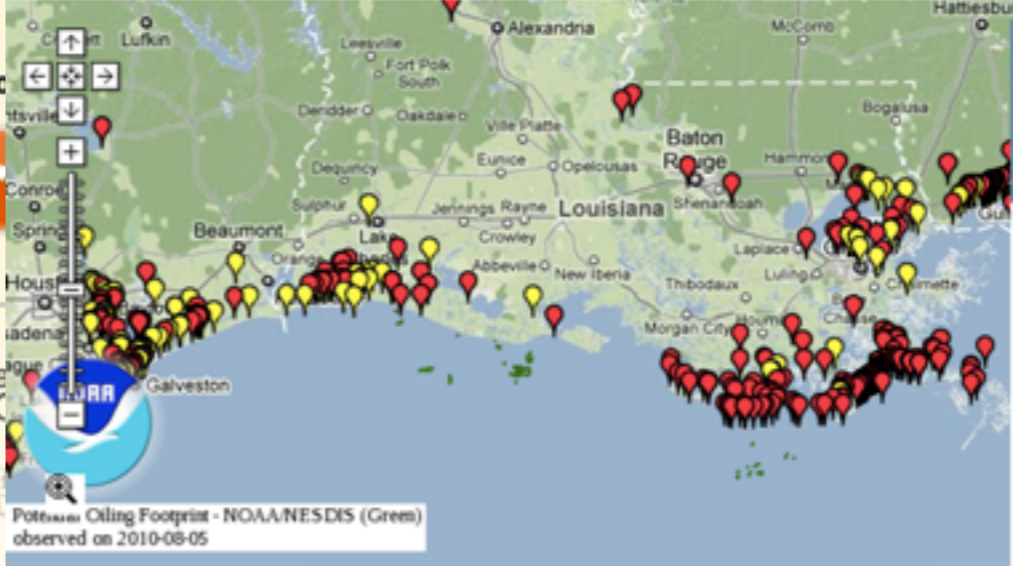
The [Rio Grande Valley Birding Festival](#) is taking place this weekend, which means that our current November eBirder of the Month will be buzzing around Harlingen corraling teams of leaders, making sure field trips get off on time, and generally making sure that the 2011 festival comes off as another huge success. Sadly, all this means that Mary won't be getting out in the field as much as she would like. So it seems like an appropriate time to recognize her not only for her hard work as field trip chair for this festival, but also for her unflinching commitment to eBird, both as a user and a reviewer. Moreover, Mary has solidified the Rio Grande Valley Birding festival's commitment to eBird by ensuring that all field trip data are entered into the system, and that all festival participants become aware of the project. This adds up to hundreds of new eBirders each year thanks to this festival! Thanks Mary, and be sure to get out (e)Birding again when things settle down on Monday!



[Possible hybrid Harlan's Red-tailed Hawk x Rough-legged Hawk in Kansas](#)
November 07, 2011

In North America, Red-tailed and Rough-legged Hawks share highly variable plumages, often causing

Gulf Spill Bird Tracker



Potential Oiling Footprint - NOAA/NESDIS (Green)
observed on 2010-08-05

POWERED BY Google | 50 mi | 100 km | eBird DataONE | NSF

Maps and data: [Google](#)
Current spill location: [NOAA](#)
Forecasts: [NOAA-NESDIS](#)

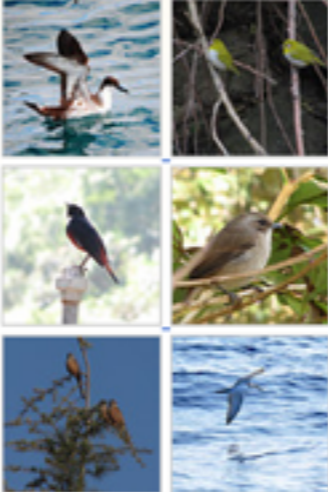
Brown Pelican

Recently removed from the endangered species list, the rebounding population nests on coastal islands throughout the impact zone.

SIGHTINGS

- Sightings Cluster
- Within last 30 days
- Older than 30 days

eBird Rarity Photos Pool



Amazon Mechanical Turk

The screenshot shows the Amazon Mechanical Turk homepage. At the top, there's a navigation bar with the Amazon Mechanical Turk logo and the tagline "Artificial Intelligence". To the right, there are links for "Your Account", "HITS", and "Qualifications". Below this, there's a secondary navigation bar with links for "Introduction", "Dashboard", "Status", and "Account Settings". The main content area features a yellow banner with the text: "Mechanical Turk is a marketplace for work. We give businesses and developers access to an on-demand, scalable workforce. Workers select from thousands of tasks and work whenever it's convenient. 185,774 HITS available. View them now." There are also links for "Sign in as a Worker" and "Requester".

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



or [learn more about being a Worker](#)

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



Amazon Mechanical Turk



Your Account

HITs

Qualifications

253,412 HITs
available now

All HITs | **HITs Available To You** | HITs Assigned To You

Find containing that pay at least \$ for which you require Master

All HITs

1-10 of 32004 Results

Sort by:

[Show all details](#) | [Hide all details](#)

Classify Arabic Tweets Dialects SEE REVISED HIT

Requester: Chris Callison-Burch	HIT Expiration Date: Aug 4, 2013 (9 weeks 6 days)	Reward: \$0.00
	Time Allotted: 60 minutes	HITs Available: 23530

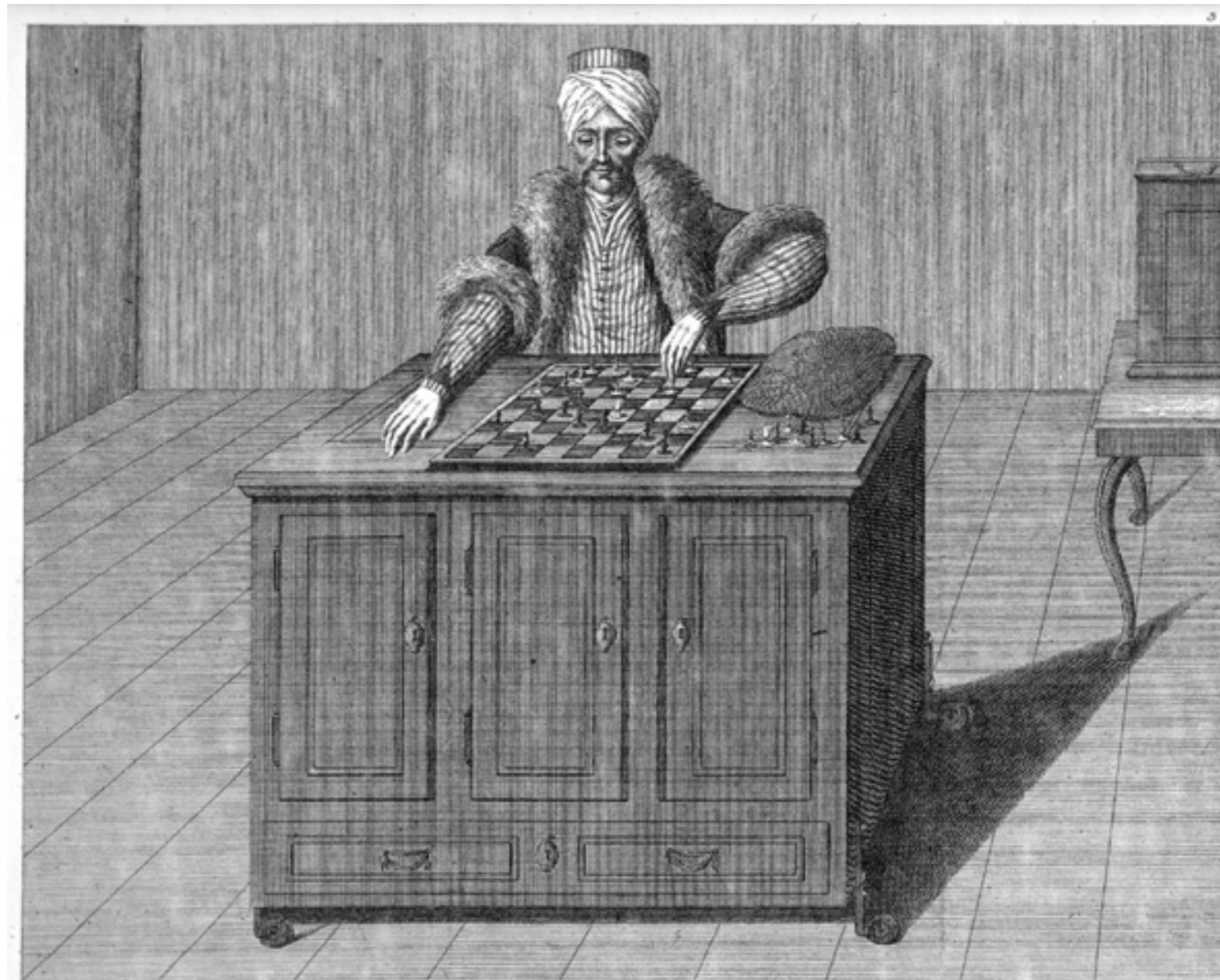
Identify whether the phrase/keywords belongs to the category provided?

Requester: InterestProfiler	HIT Expiration Date: Jun 21, 2013 (3 weeks 4 days)	Reward: \$0.01
	Time Allotted: 10 minutes	HITs Available: 17969

Search: Keywords on Google.com (US)

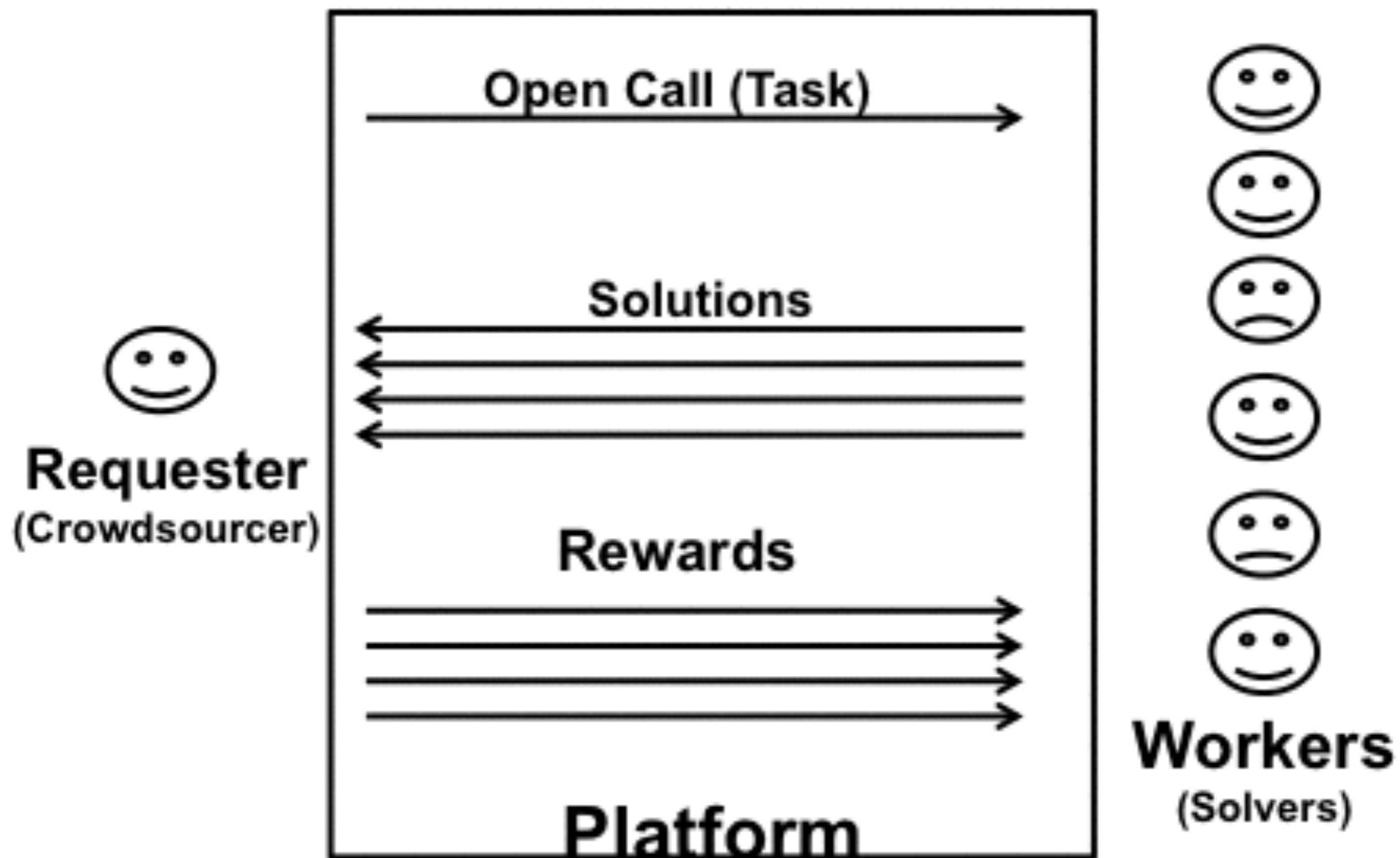
Requester: CrowdSource	HIT Expiration Date: May 27, 2014 (52 weeks)	Reward: \$0.08
	Time Allotted: 16 minutes	HITs Available: 14969

Mechanical Turk



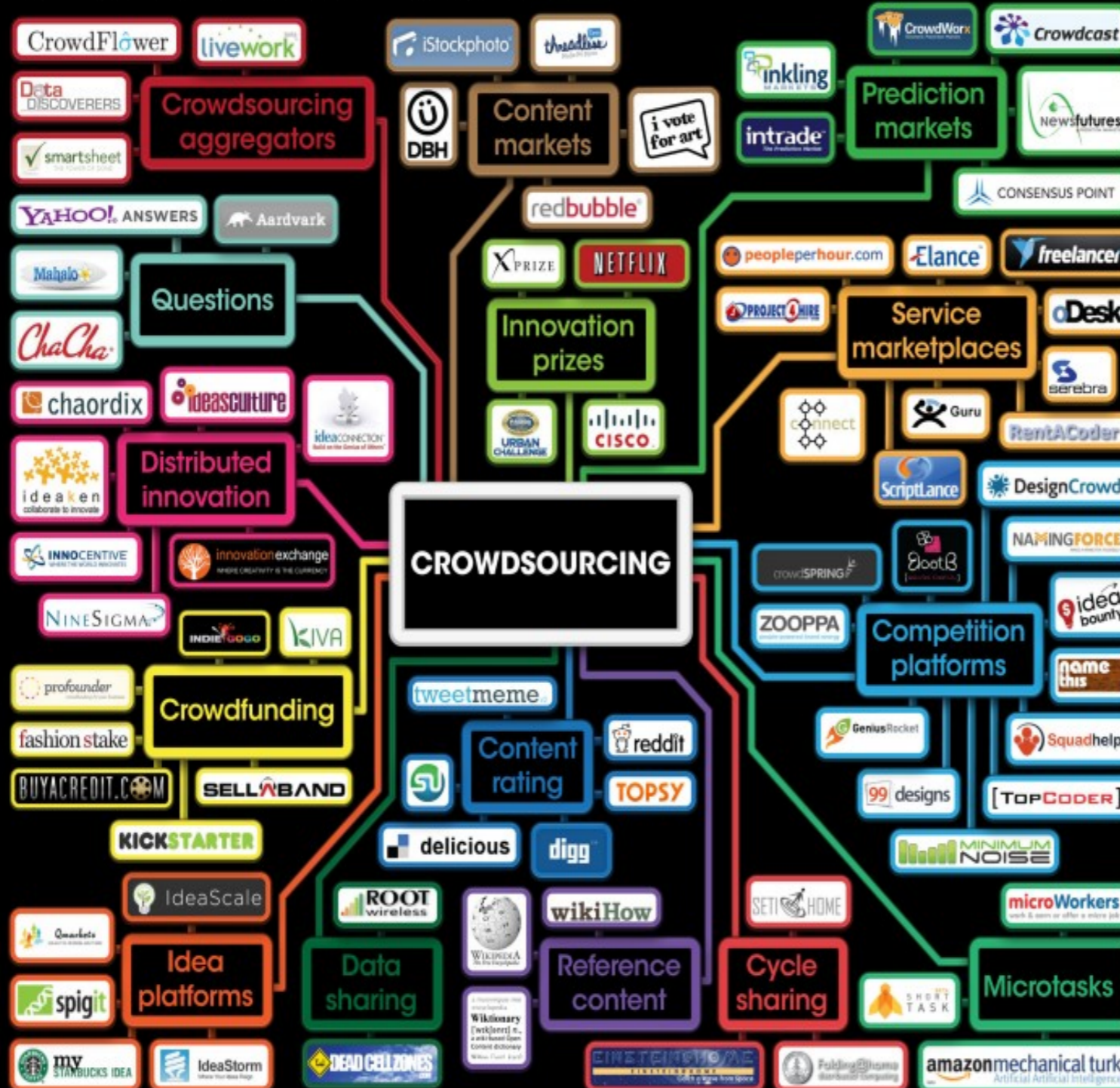
W. de Kempelen del. Ch. à Michel exaud. Basilea. P. G. Pintz. sc.
Der Schachspieler im Spiele begriffen. Le Joueur d'Échecs tel qu'on le voit pendant le jeu.

众包



众包

CROWDSOURCING LANDSCAPE Beta v1



Common Crowdsourcing Tasks and Examples

3D object design	Thingiverse
Advertising	idea bountly
Business ideas	idea bountly
Clothing	Ushahidi
Consumer research	ChitAdvisor
Crisis information	Ushahidi
Data analysis	SETI@HOME
Fact checking	PolitiFact.com
Graphic design	99 designs
Human reading	oDesk
Investigative reporting	theguardian
Journalism	seed
Lending	ZOO
Mapping	SETI@HOME
Movie reviews	IMDb
Music	musicmatch
Observation	GALAXY ZOO
Patent research	JANIPOL Data Platform
Philanthropy	SETI@HOME
Political activism	MoveOn.org
Product design	MUJI
Proofreading	oDesk
Scientific problems	fold it
Software	SETI@HOME
Software development	RentACoder
Software testing	oTest
Stock picking	Marketocracy
Tagging	Google
Translation	facebook
Trends	TRENDANTER
TV programming	current
Word of mouth	BzzAgent
Writing and editing	oDesk

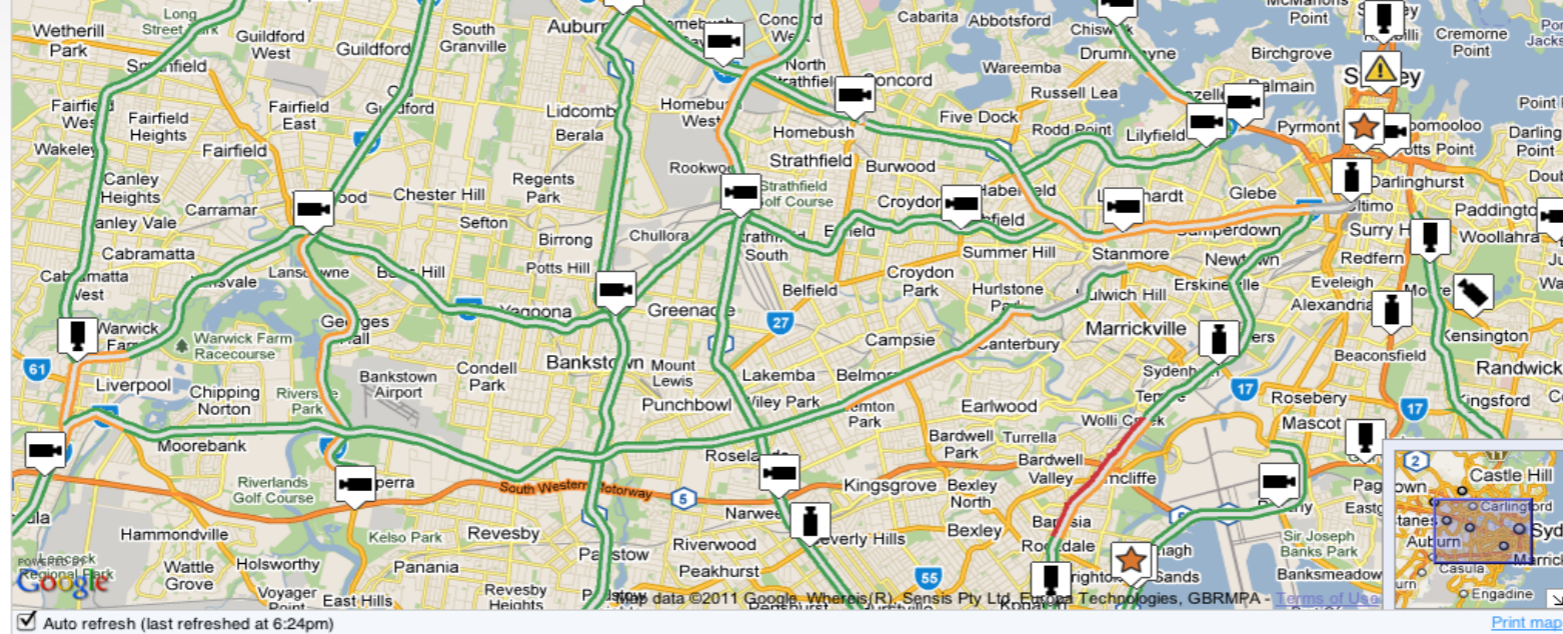
For details, analysis, and discussion go to:
www.crowdsourcingresults.com

Advanced Human Technologies
 Published under a Creative Commons Attribution-ShareAlike 2.5 License
 Created by Ross Dawson
 Design by Daniil Alexandrov

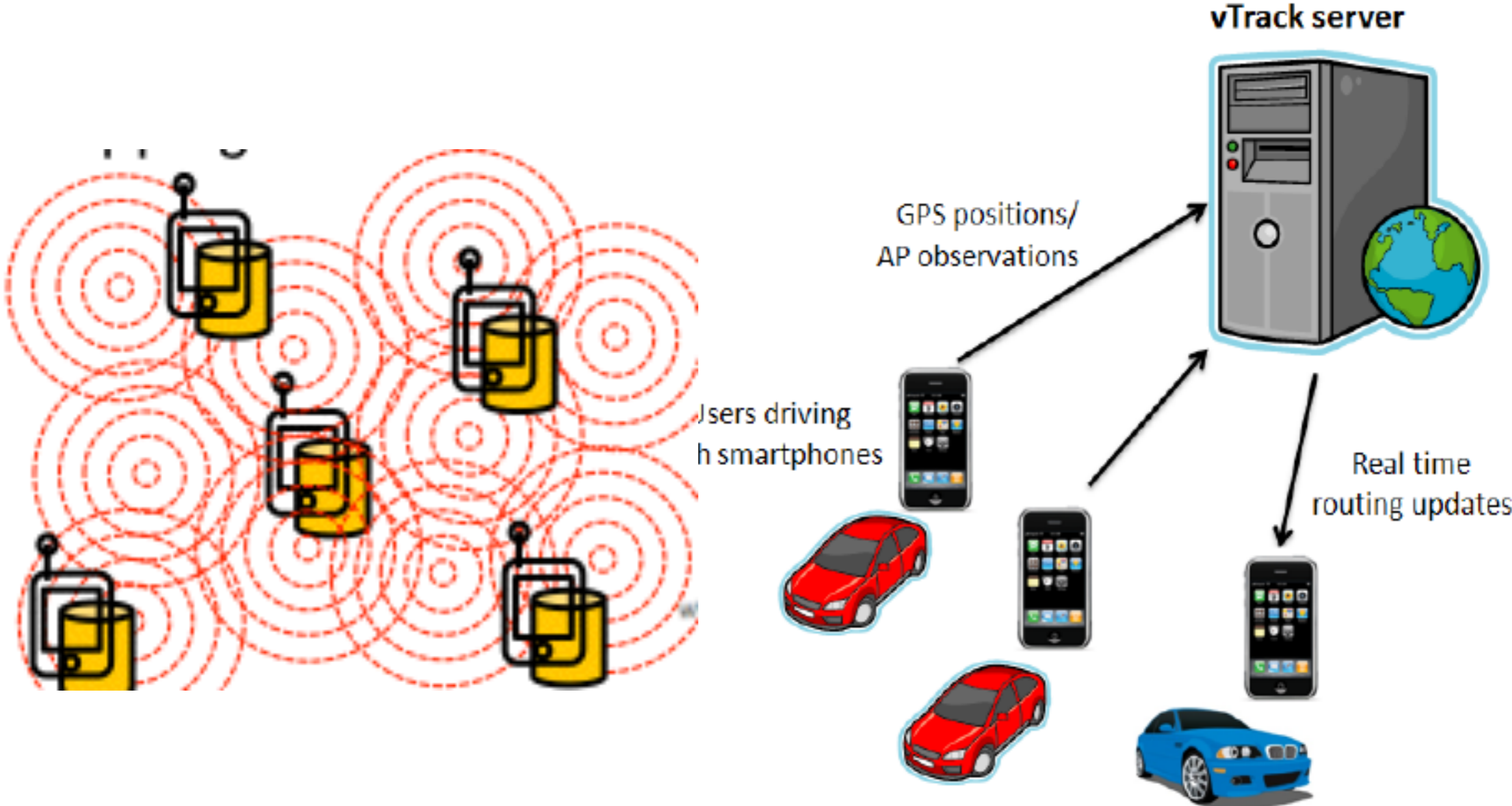
道路监控



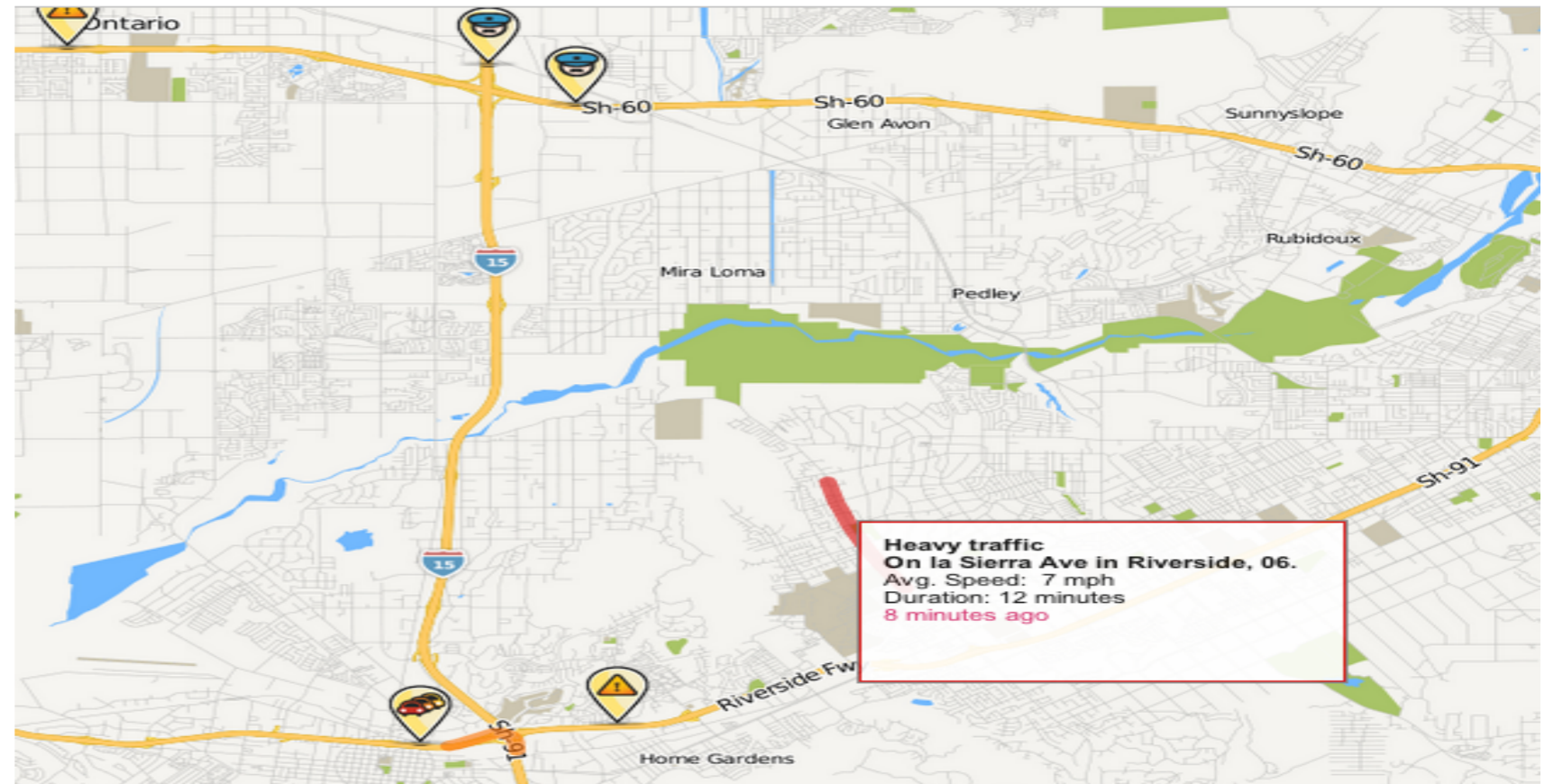
The screenshot shows the NSW Transport Roads & Traffic Authority website. At the top, there is a navigation bar with links for LOGI, COLLOQUIUM, MSDN, BIBLOG, BANNER, FinanceApp, KEDIMA, EPSS, and BILLS. The NSW Government logo and the authority's name are prominently displayed. Below the navigation is a 'My journey' section with input fields for start and end points and a 'GO' button. A 'Traffic hazards' section is active, showing a list of hazard types for the date 18/03/2011: Incidents (6), Scheduled road work (116), Major events (4), Fire (0), Flood (5), and Alpine conditions (0). A 'Map options' sidebar is also visible, with sections for 'Live conditions' (Traffic flow, Live Traffic Cameras, Variable Message Signs), 'Public transport' (Train stations, Ferry wharves), and 'Heavy vehicles' (Heavy vehicle checking stations, Heavy vehicle rest areas, Safe-T-Cams). The main map area shows a detailed view of Sydney with various icons representing traffic cameras and hazards. At the bottom, there is a footer with 'Privacy | Copyright | Terms | Sitemap' and contact information: '131700 Report a traffic incident • 132701 RTA traffic information line • © Roads and Traffic Authority (NSW) 2010. All rights reserved.'



道路监控



道路监控



- 要求阅读Human Computation. Part II Design:
 - ➡ *Understanding Workers and Requesters*
 - ➡ *The Arts of Asking Questions*

下次上课测试!

谢谢!

孙惠平

sunhp@ss.pku.edu.cn