# Bringing the Algorithms to the Data: cloud-based benchmarking for medical image analysis

Allan Hanbury,
**Henning Müller**,
Georg Langs,
Marc-André Weber,
Bjoern H. Menze, and
Tomas Salas Fernandez

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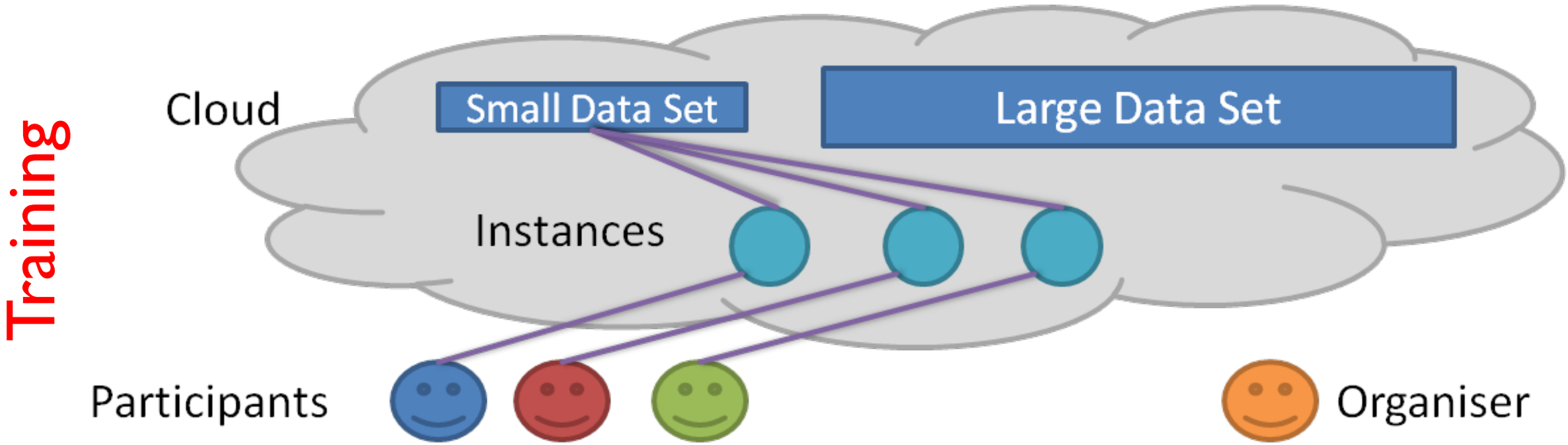
# Background & Motivation

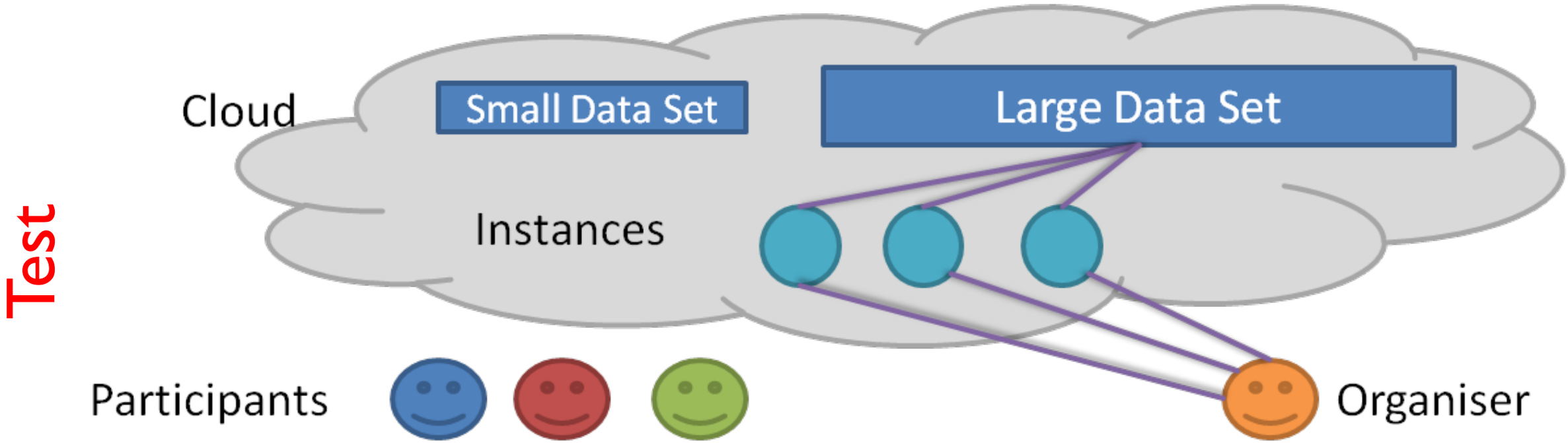
- Massive amounts of unstructured radiological imaging data produced (estimated 30% of world storage)
  - Essential for diagnosis and treatment planning
- Amount continuously increasing as radiological imaging modalities become more complex
- Converting to structured data allows automated processing and data mining
- Many medical imaging research groups working on this problem do not have access to sufficiently large-scale annotated data
  - Manual annotation is expensive

# Benchmarking Big Data

- Distributing terabytes is hard
  - Sending hard disks, download is not feasible
  - Bringing algorithms to the data is necessary
- Manual ground truthing does not scale
  - Crowd-sourcing scales better but medical data requires specific knowledge
  - Silver corpus requires the use of automation — crowd-sourcing the algorithms
- Motivating participants
  - Tasks with general interest and few infrastructure barriers (how to store or treat terabytes ...)
  - Allow sharing infrastructure

# The VISCERAL Plan

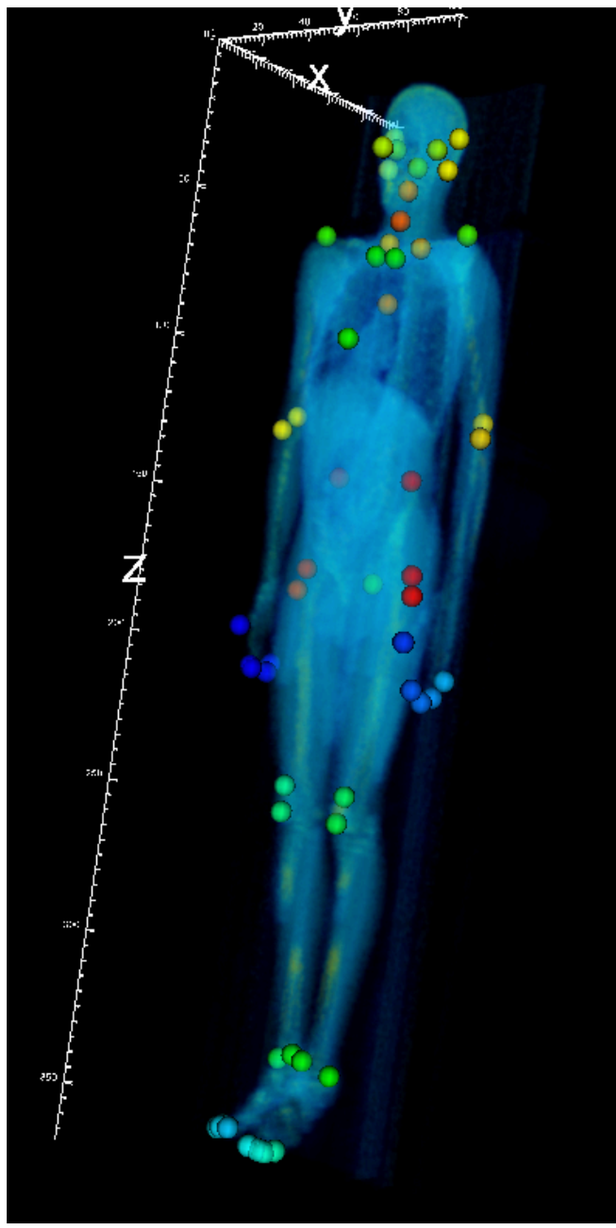


# Tasks

## 1. Identification, localization and segmentation

- Organ identification and the segmentation of bones, inner organ and relevant substructures
- Open for participation in August-November 2013



## 2. Retrieval

- Use visual and text information to retrieve similar cases to the query case
  - Visual: 3D radiology images
  - Text: radiology reports
- Open for participation in May-August 2014

# Advantages of the Cloud Approach

- No downloading or sending around of huge amounts of data
- Allow participants to use their choice of operating system and environment
- Same processing power for each participant
  - Can also allow comparison of computational performance
- Could allow evaluation on restricted/private data
- Initial step toward allowing easier sharing of components between participants

# Ground-Truthing

- Silver Corpus
  - Majority vote of the results of all participants
  - Can increase the size of the annotated data used for evaluation
  - Danger of domination by systems using similar techniques
  - Disagreements could be manually judged
- Gold Corpus
  - Small corpus manually annotated by experts
  - Used to validate
    - the silver corpus
    - the evaluation results obtained using the silver corpus

# Conclusion

- Bringing algorithms to the data is a good solution to evaluation on big data
- Investigation of ground-truthing of big data through the use of silver and gold corpora
- Will allow evaluation on volumes of data commonly produced in hospitals
- Bring medical image analysis closer to clinical routine
- Information to become available on http://visceral.eu/