**Introduction**

**Online crowd-sourcing**
- A large number of conversations happen online.
- Deploying dialogue systems online gives access to a large number of participants.
- HTML5 technologies support developing dialogue systems better.
- Crowd-sourcing saves money and time.

**Designing and development of interactive spoken dialogue systems online**
- Human-Human (N=326) & Human-Agent (N=150) systems built and deployed.
- Data from crowd-sourced Human-Human interaction used for building the agent.
- NLU, ASR, Dialogue Manager (DM) incremental in nature.

**Task**

- RDG-Image game: Two player collaborative spoken dialogue game.
- Director: Describes the image highlighted
- Matcher: Guesses the image based on the clues from Director.
- Game is fast-paced with acknowledgements, overlapping speech, disfluencies, laughter etc.

**Results**

- **Study 1:** Human-Human Data Collection 1 (N=196) [1]
  - Developed 3 different versions of the agent operating on 2 different optimization policies.
  - Money and time saved.
  - Agent is very interactive, real-time and responds at word level.

- **Study 2:** Human-Agent Evaluation Study (N=200) [2][3]
  - Data synchronization important.
  - Measuring latency helps get fairly accurate timing for the packets.

- **Study 3:** Human-Human Data Collection 2 (N=80) (Ongoing)
  - Ongoing study collects spoken interaction data in English and German.
  - Understand the complex scene descriptions (colors, spatial language, plurals, relations) using [4]

**Future Directions**

- Develop multimodal rapid conversational agent.
- Modify the task into a tutoring task and develop a pedagogical agent.
- Develop complex policies for the agent.

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**Data Collection (PMU Framework)**

- Study deployed over Amazon Mechanical Turk.
- Spoken dialogue data collection, transcription and evaluation performed in crowd-sourced manner.
- We use Pair Me Up (PMU) [1].
- Data synchronization important.
- Measuring latency helps get fairly accurate timing for the packets.
- High latencies can impact data and user performance [1]

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**Design & Interface**

**Architectures**

- HUMAN - AGENT ARCHITECTURE
- INTERFACE AS SEEN BY THE USERS

**Figure 1:** Shows users conversing about the highlighted image.

**Figure 2:** Shows Game interface used for another version of the game used for English & German data collection.

**Figure 3:** Protocol for conducting the study on Amazon Mechanical Turk.

**Figure 4:** Latency measurement protocol.