FindItOut: A Multiplayer GWAP for Collecting Plural Knowledge

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Abstract
Limited contextual understanding and lack of commonsense knowledge of various types and about diverse topics have proven to be the pitfalls of many real-world AI systems. Games with a Purpose (GWAP) have been shown to be a promising strategy in order to efficiently collect large amounts of data to train AI models. Yet, no GWAP has been proposed to collect specific types of knowledge — discriminative, tacit, or expert knowledge. Inspired by the popular game, Guess who?, we present FindItOut. In this GWAP, two players compete to find a target concept among several by asking each other questions in turns, using a set of relations, and entering natural language inputs, with an aim to discriminate the target concept from others. The data created by the players is then processed, and can be appended to existing knowledge bases to be exploited by AI systems.

Introduction
Access to knowledge is necessary in many areas of computer science (Smart 2018; Zang et al. 2013), and has become even more important with recent advances in AI and machine learning to serve a large breadth of use-cases (Davis and Marcus 2015; Gadiraju and Yang 2020). World knowledge is pivotal to assess the validity of “knowledge patterns” acquired by machine learning models and surfaced by recent explainability works (Samek, Wiegand, and Müller 2017; Samek et al. 2019) for large scale NLP (Lertvittayakumjorn and Toni 2021) or computer vision (Kang et al. 2018) inference tasks. In recent neuro-symbolic AI works, the knowledge is also integrated into the models for them to learn inference mechanisms that should be more accurate as they do not solely rely on potentially biased statistical data patterns (Gaur, Faldu, and Sheth 2021; Kapanipathi et al. 2021).

Knowledge engineering (Simperl, Acosta, and Flöck 2013) is the research area that focuses, among others, on developing methods to gather knowledge. This is done by interrogating humans through simple interfaces or complex interactions such as games with a purpose (GWAP), by mining textual resources, or by logically reasoning about known facts to infer new ones (Zang et al. 2013).

Knowledge can be categorized with different typologies of qualities depending on its envisioned use (Pritchard 2013). It can vary from explicit to tacit (Nonaka and Takeuchi 2007), situational to conceptual (De Jong and Ferguson-Hessler 1996), discriminative to generative (Krebs, Lenci, and Paperno 2018), general to specific, commonsense to expertise (Singh et al. 2002; Witbrock et al. 2005), etc. Although GWAPs have been shown to be promising to efficiently collect knowledge, the types of knowledge they can support have not been studied extensively, and seem limited, e.g. not discriminative and possibly not tacit.

We propose FindItOut with an aim to collect diverse knowledge for (a) AI practitioners to perform AI tasks more effectively, and (b) for researchers to characterize the types of knowledge one can set out to collect through GWAPs.

Game Overview
FindItOut is a competitive game played by two players who take turns being the Asker and the Replier. Figure 1 displays the player interface. At the start of the game, both players are presented with the same board of multiple cards, where each card corresponds to a concept with its name, picture (generated from Google Image Search), and definitions (taken from WordNet). The game assigns one of the cards on the board to each player as their IT card. The goal of each player is to guess the opponent’s IT card by asking questions and reducing the possible candidates at each of their turn. The cards on the board can be flipped, which help the players keep track of the possible choices.

Gameplay
Execution of a turn. At the beginning of a turn, the Asker chooses an action between (a) “ASKing” a question to the Replier, and (b) “GUSSing” their IT card. The GUESS action directly ends the game with the Asker winning if the guess was correct, and losing otherwise. The ASK action requires the Asker to formulate a question. The Replier answers, the Asker flips relevant cards, and the next turn begins with players switching their roles.

Question and answers. The questions follow a single template <relation, input>, where the relation is selected among a pre-defined set of relations extracted from ConceptNet (Liu and Singh 2004) (IsA, HasA, HasProperty, UsedFor, CapableOf, MadeOf, PartOf, AtLocation), and the input is a natural language proposition limited to five words (for
The collected knowledge is characterized in more specific knowledge collected. We also propose an input generating general knowledge, while similar initial concepts result in more general knowledge, hence the need to propose relevant sets of knowledge. We plan to further expand the data processing pipeline to ensure the validity of collected knowledge. For instance, depending on the available budget, game sessions with the same initial board can be repeated to aggregate answers.

Characterization. Initial experiments have shown that the type of knowledge collected in a game session and across game levels varies. Initial cards with similar concepts nudged players to think of tacit knowledge to ask about, to efficiently discriminate across many concepts. Having more cards often forces players to think of specific pieces of knowledge, especially towards the end of the game since cards remaining unflipped are more similar (cf. Table 1).

System. The overall system is implemented as a web game with a backend in Python Flask and frontend in React and Redux. The real-time game communication is achieved using SocketIO. This allows for a large number of simultaneous games. We support interactions with volunteer players connecting onto the platform, and with players recruited from crowdsourcing platforms for experimentation.

FindItOut is a GWAP that facilitates the efficient collection of diverse types of knowledge. In the imminent future, we will study and improve player experience, while contrasting the needs of differently motivated players (paid or unpaid). The game is available at https://finditout.vercel.app/.
References


