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## 1 Research Interests

My research interests lie generally in the area of **spoken dialogue systems** with particular interest in **software engineering** techniques to **dynamically integrate structured knowledge sources**, like databases and **ontologies** (Paulo Pardal, 2007), and in **evaluation frameworks** that allow measuring the advantages. The challenges of creating **tutorial and educational systems** that can be used by the **general public** at their homes, schools or museums are also part of my research. This includes the use of general resources like those usually provided by Question-Answering systems (Mendes, 2008). Finally, I am also interested in the creation of emotion models to enrich the agents with **emotional behavior** that changes according to the dialogue's flow and the systems' success.

### 1.1 Background and related work

DIGA (DIaloG Assistant), the domain-independent framework for Spoken Dialogue Systems of L<sup>2</sup>F was created back in 2000 (Mourão et al., 2004) The framework is highly inspired on the TRIPS architecture (Allen et al., 2005): it is frame-based and is used to build domain-specific dialogue systems. Every domain is described by a frame, composed by domain slots that are filled with user requests. Several systems were already created with this framework: a bus ticket vending system, that provides access to buses timetables; a digital virtual butler named *Ambrósio* that controls home devices; a prototype system that helps the user perform some task (tested for cooking and automobile repair domains); and two telephone-based systems (home banking and digital personal assistant). *Ambrósio* is publicly available at the "House of the Future" ([www.casadofuturo.org](http://www.casadofuturo.org)), on the Portuguese Telecommunications Museum since 2003. The telephone-based systems were developed under the project TecnoVoz ([www.tecnovoz.pt](http://www.tecnovoz.pt)), a Portuguese national consortium including Academia and Industry partners. The integration of the framework into commercial products led to a major reengineering process (Martins et al., 2008b). Also, some improvements on the parsing method were needed to deal with different data types (Martins et al., 2008a).

### 1.2 Past and current work

Most practical dialogue systems are designed for a specific task, and even if the authors were concerned with possible future extensions, integrating new tasks is always a challenge. Work has been done to take advantage of some programming paradigms to ease this process. Dynamic integration of new tasks according to some kind of structured knowledge is an interesting research topic.

The use of databases has been shown to ease the extension of a system to new tasks since we can extract domain knowledge from the tables' structure and create systems that generically use that kind of information. Given that the ontologies can be seen as an upgrade of databases (whereas richer information can be stored) a new methodology will be proposed that will use domain knowledge collected in a ontology, gathering the (currently scattered) domain knowledge into a specific module. This will help when introducing new languages in the system; it also pushes the dialogue phenomena into a specific module that can be reused across different systems. Better module APIs are needed to do so.

To test this possibility, an ontology for the cooking domain concepts was built (Ribeiro et al., 2006) that was later populated with information automatically extracted from books and web sites with a natural language specific tool (Machado, 2007). Also, a first prototype was built that helps the user with the tasks needed to perform a chosen recipe.

Current work includes a survey of the state of the art and a technical report summarizing the existing dialogue systems (with a categorization according to the tasks that are performed and to the information that is used); and the systems using ontologies. Also a state of the art on generic systems that takes advantage of the use of ontologies (against the sole use of databases).

### 1.3 Future work

After DIGA has been tested as a simple tutorial system (where the system, instead of receiving orders, instructs the user to perform some steps towards a selected task), I will adapt the existing module to take advantage of ontological knowledge. The current version loads recipes

from a basic XML file. The next version will obtain that information from the database populated according to the cooking ontology. Later I will include the ontological knowledge in the system and will measure the impact of gathering the knowledge in a single data source. It is my belief that we can extract all the domain-specific knowledge that needs to be included in the systems' modules from a domain-specific ontology (vocabulary to recognize and use, domain terminology and thesaurus, translations between natural language and domain-specific keywords, etc.). It will also be interesting to declare new dialogue systems as instances of an ontology stating the needed information to declare a system. To allow real-time responses to the users it might be necessary to create some optimization mechanisms that process the knowledge stored in the ontology offline in order to enhance the integration at runtime.

## 2 Future of Spoken Dialog Research

Currently spoken dialogue systems are proposed only when no other input modalities are available (like when there is no access to a keyboard or when the user has some kind of special need – blind, reduced accessibility, etc.) However, we should consider the use of speech whenever it is natural. That would be easier if interaction with this systems was more natural (more similar to human-human interaction).

Research in psycholinguistics has shown that continuous understanding plays a major role in language understanding by humans. This can be seen by the completion of what the interlocutor is saying or by response earlier than the end of a sentence. Capturing human continuous understanding behavior in a multimodal dialogue corpus (Gomez-Gallo et al., 2007) is an initial step towards natural interaction.

When human-computer interaction approaches human-human interaction, people will feel comfortable on delegating some tasks to a digital helper while they will concern themselves with some other tasks. This also needs to consider the right time to interrupt and managing priorities.

## 3 Suggestions for Discussion

- Question-Answering: architectural needs and dialogue handling to take advantage of the knowledge store in the database/ontology.
- Teaching SDS (methods, frameworks, evaluation) and SDS for Teaching (tutorial and educational applications).
- Evaluation: universal metrics for comparing disparate systems, tasks, languages and modalities; expert systems against rapid development frameworks.

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## Biographical Sketch



Joana Paulo Pardal is a 3<sup>rd</sup> year Ph.D. student in Informatics and Computer Science Engineering at IST, UTL, under the supervision of Nuno J. Mamede (IST), H. Sofia Pinto (IST) and James F. Allen (U. Rochester). She holds a fellowship from FCT (Portuguese Nat. Science Foundation). Joana received a *licenciatura* (a 5 year full-time degree) in 2001, and an M.Sc. in 2004 both in Informatics and CS Eng. from IST. Joana is a researcher at L<sup>2</sup>F since 2001. She is a Lecturer at IST since 2002. She is a student member of ISCA, ACL and AAAI and participates on CMU *DoD* reading group. In 2004 she worked at GRIL, U. Blaise Pascal, Clermont-Ferrand, France. In 2006 she spent a research term at the CS Dept., U. of Rochester, NY, USA.