Directed and undirected computer assisted language learning, collaboration, and lifelong learning

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Introduction

Concrete implementations, large studies, and undirected learning have been highlighted as areas of further work for approaches to learning which draw inspiration from the Framework for Lifelong Learning (FoLL).
The CLLE system is designed to assist learners in learning the mandarin chinese language and two main parts of the system are highlighted.

Every action of the learner is recorded in the form of "trails" which allows them to record & re-visit their past learning actions and examine those of other learners. This re-visiting can be via textual filters or graphical graph views. The system can also examine these trails and suggest future courses of action to the learner which have proved fruitful to other learners. By providing a portable, complete record of the users learning the system seeks to avoid it's users making the same mistakes again.

The 2nd part continues with the theme that visual, interactive interfaces assist with learning by exposing the syntax-tree structure of the target language to the learner and encourage them to think in terms of grammar blocks and formal transformation rules to understand the structure of their chosen language. Sentences can be built from blocks or can be imported from finished text to analyse the grammatical structure of the sentence.

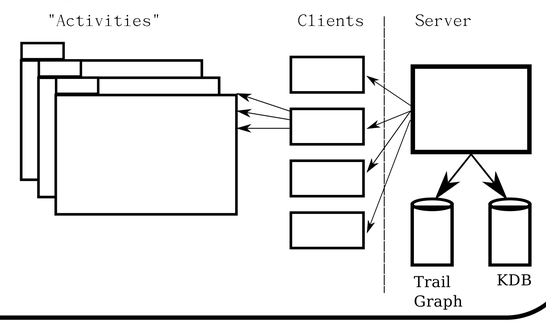
As on-going work, several questions are raised which could be answered by extensions to the system.

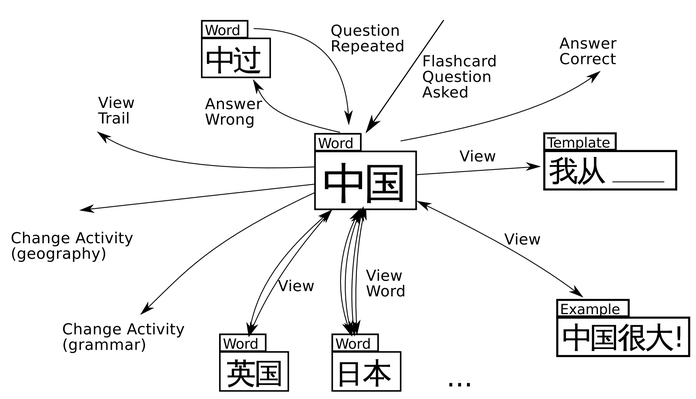
Architecture

Lifelong learning proposes that ad-hoc learning is as frequent and important as formal classroom learning and the architecture of CLLE has been designed with this in mind. A central server stores the global knowledge database (KDB) and trail graphs and provides log-on and authentication services to maintain confidentiality. All client communication is via the server (rather than peer-to-peer) using a text-based protocol.

Long term architecture:
Everything the user does is stored in the trail graph and KDB forever and there is a local cache of all their personal data. Even if the central servers suffer data loss the user does not lose data, and server data can be rebuild from caches. The same applies should the user lose their local cache.

Location Neutral:
- All data can be rebuilt over the network
- Local cache allows use without network
- Front-end is seperated into "activities" so it can be reduced in size for mobile devices. (Consider size limits for midlets and a single feature per midlet)



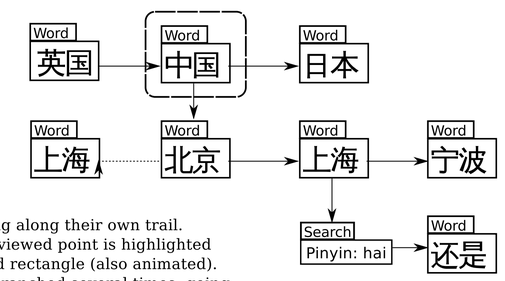


Every action that the user performs in the system is logged. It is as fine-grained as viewing a different word, trying a different grammar block, or even viewing the log itself, and is added to the trail graph in the server. This is a visualisation of all the events of all the users using that server in which nodes represent objects in the KDB and edges typically represent events which changed the learners "state". A users entire learning experience should be recreatable from this trail. Edges are weighted by the number of users who have performed that event.

Trail Graph & Collaboration

At it's lowest level the trail graph is just a database table which stores the timestamp, user, type of event, and parameter data. This makes it simple to track trends in user activity. By subtracting general long-term event patterns the it can display what is "fashionable" in the system, and therefore hopefully appearing in the target language.
In comparison to Google Zeitgeist which gave extensive summary statistics on what users were searching for, the system can show what words, grammar structures, etc, are being examined by other users due to their use in general world events and possibly attempt to pre-emptively integrate them into the users vocabulary.

Date	Spike in events	English	Real world events at this time
8/8/2007	梦想	dream	Olympics 1 year to go celebration
8/8/2007	奥林匹克	Olympics	Olympics 1 year to go celebration
Summer 2006	点球	penalty	World Cup 2006
Summer 2006	守门员	goalkeeper	World Cup 2006
~1 month before end of term	考试	exam	Exam period
~1 month before end of term	不及格	fail	Exam period

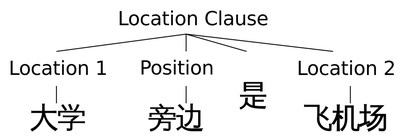


User navigating along their own trail.
The currently viewed point is highlighted by the rounded rectangle (also animated).
The user has branched several times, going from chinese cities to words containing the pronunciation "hai". It also shows that in the past the user has viewed the Shanghai node.

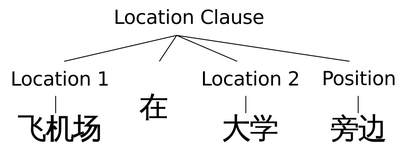
Learning a language is an inheriently branching activity, doubly so when it is undirected. When the learner sees an occurence of a new word on the street or in another example they typically immediately want to know what it means. That in turn may lead to other new words or grammar structures. Most language programs have only very basic navigational and history support and so do not allow the learner to do this without having any hesitation for fear of not being able to get "back on track".
The trail provides a mechanism by which advanced history and navigation facilities can be provided. They can explore branches and easily return to the "main line", identify loops, and see repetitions in their previous actions.

Grammar Mapping & Visual interaction

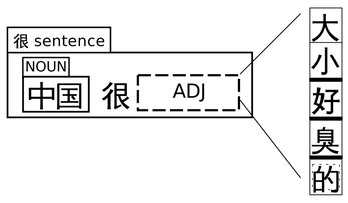
The majority of language software focuses on the word level of the target language but CLLE attempts to support all levels of the language (although paragraph & above are still the subject of future work).
Objects in the trail graph & KDB are not restricted to just words.
The grammar mapping feature of CLLE stores grammar blocks - elements of the syntax tree of the target language. Using these blocks, in a visual, interactive manner, allows the user to experiment with combining different grammar structures in a way that is guaranteed to be correct. A sentence can be given to the system and it will automatically parse simple sentences. These can then be viewed as flat, plug-in blocks or expanded into a syntax tree. Like all features, the grammar mapping feature is integrated with the trail system so can suggest trail objects which may be appropriate for the current situation.



User transforms between 2 different forms of the location grammar block. The transformation is animated and the subtrees pivot to their new location.

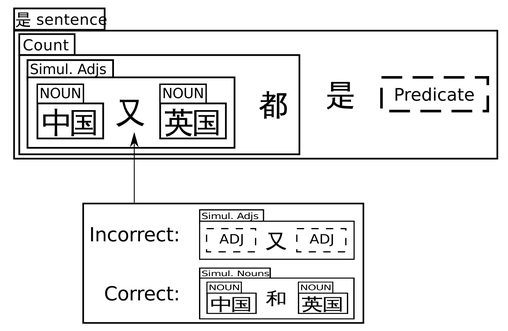


When the user enters a sentence into the grammar mapper the tool will parse the sentence and tell the user the grammatical structure of the sentence. It is proposed that undirected learners will make heavier use of this facility than directed learners as they will not have an instructor to correct practice sentences. Regardless of type, should the user have entered a sentence with incorrect grammar the mapper can in some situations highlight and suggest corrections to the user. It is also proposed that, just as with a class of students and an instructor, the learners that make heavy use of this facility will all develop a similar grammatical style.



When constructing a new sentence and the user hovers over an unfilled block the trail system offers suggestions which most frequently appear and opposites, intensity scales, and nested grammar blocks to the user.

The syntax tree structure and the interaction with blocks of grammar lends itself well to treating moving between different grammar structures as formal, strict transformations of the original syntax tree into the new tree which has the desired language properties. Some grammar blocks have associated transformations with them, which are typically alternative ways to communicate the same thing. Other grammar blocks perform more whole-sentence transformations such as changing the tense of the sentence which may require re-ordering the sentence sub-blocks, or changing words to their appropriate tense equivalent, or passive and active voice.



Directed & undirected learning

It is proposed that the temporal and spacial structure of the trail graph will reveal differences in the methods of learning that directed (ie, undertaking formal instruction with teachers and curriculum) and undirected (ie, individuals or ad-hoc groups) learners use in their studies. While undirected learners usually have no curriculum, they may have specific goals of competency in specific areas of the language rather than just aiming for general skill advancement. Several questions have been suggested about the different groups behaviour which CLLE may specifically investigate in future large-scale studies.

- Do directed or undirected learners do the same amount of "exploration" of the trail graph than learners in the other group? Undirected learners are seen as learning diverse parts of the language as they encounter them, yet experience suggests that directed learners do just as much "roaming" but without instructor support.

- Within directed learning contexts, how do the trails of individual learners in a class compare and are any specific behaviours present in a statistically significant proportion of high or low achievers which are not present in the rest of the class?

- The system gives it's users a large amount of information about what their fellow users are doing. In a directed context, could this increase the amount of cheating by simply watching other users get to the most popular answer?

Conclusions & future work

The CLLE system is on-going research work. Prototypes of parts of the system have shown that trail graphs can be constructed at adequate levels of detail to create a detailed multi-user trail graph without encountering storage problems. This detail is sufficient to create detailed history tools for the user. Indeed, the history is currently too detailed to be generally usable because the relevant filtering algorithms have not yet been explored. The grammar mapping tool can currently only cope with a relatively simple subset of Mandarin but this should be improved by reusing components from groups whose primary research is Mandarin grammar.

The most pressing point of future work is to clean the system up so more end users can use the system without assistance. This will help in gathering more usage data to direct further development. After this, proper trials should be possible with (directed) Mandarin modules and (undirected) staff language study at the University of Nottingham, Ningbo campus in China.

Long term goals for CLLE include expanding the system to cope with English and Arabic. These are languages which are structured and studied in very different ways from Mandarin and so will test the flexibility of the program to encompass all the users learning activities - one of the requirements of the FoLL.

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Acknowledgements

I would like to thank,
The University of Nottingham, Ningbo &
Learning Sciences Research Institute
for their assistance in allowing me to
attend this conference.

Further information

Further information on the progress of this project, and potentially a client to download to participate, will be available on the new staff website of the University of Nottingham, Ningbo during the next semester at http://www.nottingham.edu.cn
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