Building Intelligent Digital Assistants for Speakers of a Lesser-Resourced Language

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Commercial Digital Intelligent Assistants

- Using digital assistants via intelligent speech interfaces increasingly popular
- Used for command and control as well as receiving answers to questions voiced in natural language
- Commercial products: Apple Siri, Google Now, Microsoft Cortana and Amazon Alexa
- Developers and third-parties are encouraged to extend their capabilities via APIs (Application Programming Interfaces) and SDKs (Software Development Kits)
- Mainly provided in English, and to a lesser extent some other major languages
- Unlikely to extend to support smaller languages such as Welsh, in the near future
- No means for external developers to adapt systems for new languages
- Undermines digital linguistic diversity in lesser resourced language communities

‘Seilwaith Cyfathrebu Cymraeg’ Project

- ‘Welsh Language Communications Infrastructure’ Project
- 8 month project funded by the Welsh Government and S4C (Welsh language public service television channel)
- Aim is to include Welsh speakers in the evolution of human computer interaction by:
  - Developing a prototype intelligent digital assistant for Welsh speakers
  - Improving language technologies, especially speech recognition for Welsh
  - Applying these technologies in the prototype
  - Make all resources openly available, with no restrictions, in order to encourage further developments in intelligent digital assistants for Welsh and other lesser resourced langauges

Towards supporting Welsh

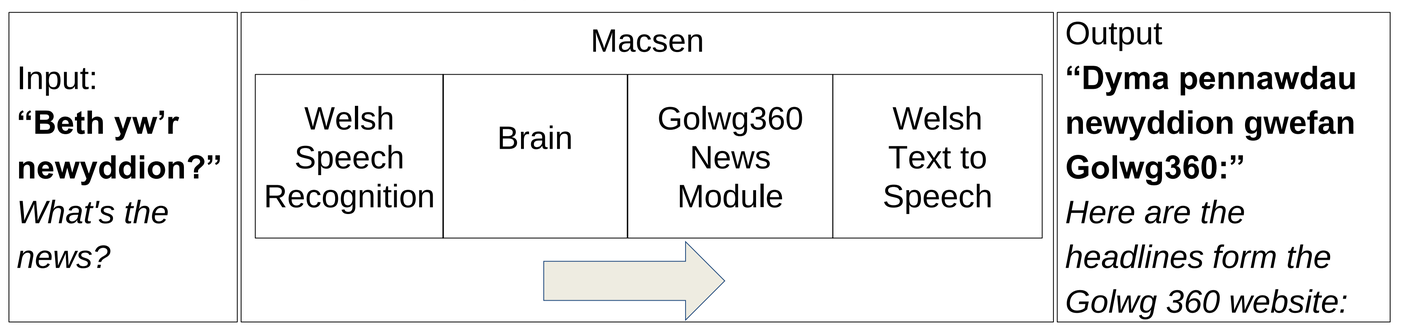
- Commercial architectures have speech recognition and natural processing in one super-component
- Building a Welsh language digital assistant is feasible only with more granular and open architectures:
  - A Welsh language speech recognition engine can be integrated
  - The NLP for understanding requests can be adapted or replaced
  - Welsh responses can be provided via text-to-speech
  - Capabilities rooted in English can still be used

Improving Speech Recognition

- Previous work on Welsh language speech recognition provided:
  - Welsh letter to sound rules
  - a crowd sourced speech corpus (via the iOS/Android based app Paldaruo)
  - a basic robotic arm command and control demo built with HTK and Julius
- To further this we:
  - Trained acoustic models for all Welsh language phones from the entire Paldaruo speech corpus
  - Encapsulated our HTK based training environment in Docker
    - training scripts cater for the fact the the Paldaruo speech corpus has not been humanly evaluated and edited
    - Paldaruo does not provide a test corpus: training data used for evaluation
      - Beneficial in automatically identifying and filtering out low quality or erroneous speech recordings
      - Used word loop grammar as basis for testing
  - Used our HTK Docker environment to improve acoustic models word accuracies: from 20% (from all 410 speakers’ contributions) to 92% (from 88 speakers’ contributions)
  - Developed a comprehensive language-specific HTK decision tree clustering script file (tree.hed) which improved word and sentence accuracies by 1%

‘Macsen’ Prototype Welsh-language Intelligent Digital Assistant

- Simple task grammar and vocabulary files for Julius developed
- Based on the ‘Jasper’ open source project for building your own digital assistant
- Capabilities can be extended with modules: Modules indicate if they can service the request
- Uses natural sounding text to speech voices by Ivona
- Runs on Raspberry Pi
- Supports answering questions and fulfilling tasks in the domains of news, weather, time, proverbs and jokes



Further work

- Improve speech recognition for Welsh with more recent tools such as Kaldi
- Create language models from corpora: 30 million word Cysill Ar-lein Corpus
- Investigate application of machine translation for consuming English services
- All models, scripts, code and data available via the Welsh National Language Technologies Portal and GitHub: http://techiaith.cymru/macsen

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S4C

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