The Dyslexia Revolution: A New Era in Text Correction

There is a quiet revolution underway in the world of learning difficulties – but this revolution is not a new teaching technique or coping mechanism. Instead and perhaps surprisingly, it is a software company that is providing new hope to people with dyslexia.

By Sharon Givon
The Dyslexia Handbook 2011. British Dyslexia Association (BDA).

According to the British Dyslexia Association, ten percent of Britons suffer from dyslexia, and four percent severely so. Thus dyslexia is a real disability, affecting the lives of millions, but its effects are often hidden. Those without learning difficulties themselves can fail to understand the nature of the condition, and as a result do not realise the role dyslexia plays in the performance of certain tasks. It can thus blight people's lives, and dyslexics may have to make substantial efforts to overcome the barriers which are (often unintentionally) put in their way.

The advent of computer spell checkers proved to be a very useful tool for writers, enabling them to produce texts with lower error rates. This however is not the case for people who suffer from dyslexia as traditional spell checkers are unable to recognise their misspellings, making incorrect or misleading suggestions. Moreover, it has been shown that up to 63% of the errors made by people with learning difficulties may not be detected at all by spell checkers (MacArthur, et al. 1996).

Current technological solutions include text-to-speech (TTS) and speech-to-text (STT) software. Both of these approaches, however, have significant limitations. The accuracy of state-of-the-art STT systems is still facing major challenges. Moreover, recognition accuracy has reached its current plateau of 80% in 2001 and no significant improvement has been reported since[1]. TTS techniques cannot identify the majority of misused words and spelling mistakes. Therefore, the two methods can only offer little help to writers.

Ineffective Technology: The Problem of Context and Dimensionality

The history of automatic spell checking and text correction is a mixed one. Traditional spell checkers work by comparing words, one word at a time, with a dictionary. If the word is not found, it is flagged as an error and a simple algorithm (such as Levenshtein distance) is used to generate a recommendation.

This technology has worked well for non-dyslexic users, with English as their first language. Casual errors are easily detected and quickly corrected. It poses certain unique difficulties for dyslexic users, though. Consider the following sentences:

> "This will effect their score"

[1] http://www.itl.nist.gov/iad/mig/publications/ASRhistory/index.html

"This will affect their score"

The first sentence incorrectly uses the noun "effects", in place of the verb "affect". A traditional spell checker is powerless here – both sentences are grammatically correct, but the first sentence has no meaning. Only knowledge of context can spot the mistake.

Consider the next example:

"My father teaches fizix"
"My father teaches physics"

The first sentence contains the phonetic spelling error "fizix". Traditional methods rely solely on letter similarity measures, but "fizix" and "physics" share only one letter – "i". In other words, the error and the correction are too different and therefore a traditional tool cannot identify the right word. A contextual spell checker on the other hand takes into consideration the neighbouring words and other linguistic features. Such spell checker can successfully identify that the correction here is "physics".

A further problem arises when too many words are included in the dictionary – as more unusual words are included, the chances of a misspelt word being recognised as a correct but different word increases. This is the problem of dimensionality.

A New Start

To solve this problem, it is necessary to define what an "ideal world" text correction tool would be able to do:

1) Detect errors in spelling, even if the misspelled word actually exists in the dictionary.
2) Detect errors in phonetic spelling.
3) Detect errors in grammar.
4) Detect errors arising from the misuse of words.
5) Provide suggestions that make sense in the given context.

Let us examine these in further detail. Consider the following sentence (errors highlighted in red):

"Eddie licks to drinks only minerals water"

Microsoft Word for instance, at the time of writing, was completely unable to correct this sentence, not least because it cannot find any errors in it. Traditionally it would require a (non-dyslexic) human editor to spot errors of this nature – or a very substantial effort on behalf of a dyslexic user. This is because all the words exist in the dictionary, and furthermore, the sentence is grammatical. The fact that it is nonsense to say "Eddie licks to drinks" or "Only minerals water" is not spotted, because Word does not understand the context.

Even in instances where a traditional spell-checker detects an error, it does not necessarily have the capability to fix it. Consider the following:

"Im not shoor we can do eat."

Word spots two of the three errors in this sentence, but if you accept the default corrections, you would get the following:

"I'm not shoo we can do eat."

This is clearly not particularly helpful. What's more, if you look at the entire list of possible corrections that Word provides for "shoor", the correct word, "sure", does not even appear on the list! Fortunately for dyslexic people, Ginger Software has a tool that can correct these errors (and corrects all the examples above without mistakes).

Ginger Software – A New Way

Ginger Software is a software company that is at the heart of a quietly growing revolution in the world of assistive technology. They provide a contextual grammar and spell checker which uses advanced artificial intelligence techniques to correct entire sentences based on context. If this sounds technical in concept, in practice it could not be simpler. You just give type in text with errors, and it corrects it at an unprecedented level of accuracy.

Ginger does this by looking at the whole sentence, and working out from context which words are incorrect. It then automatically corrects unusual spelling mistakes, misused words and grammar errors.

This may sound like magic, but it seems even more amazing when you see it in action. It seems to effortlessly identify mistakes that most programs miss, or incorrectly identify, and its use can be a transformative revelation for people with dyslexia. Yael Karov, the CEO and founder of Ginger Software, said: "Ginger provides a life-changing experience for children and adults with learning difficulties. With Ginger, many people are able, perhaps for the first time in their lives, to independently produce error-free text."

Indeed, a commercial version of Ginger Software has been available for a little over a year, and already messages of support and thanks are pouring in. Hundreds of thousands of people all around the world are already enjoying the software and the company's customer base is growing rapidly. Karin, an undergraduate student at Brunel University in London, purchased Ginger Software through the Disabled Student Award scheme. "I am dyslexic and have difficulty structuring sentences, and I have also faced grammatical problems which have left me behind in my coursework", she told us. "I now use Ginger Software, which helps me tremendously and gives me feedback about my mistakes. I think Ginger Software is brilliant for dyslexic people."

Look at the following set of examples and ask yourself, could your spell checker correct these errors?

1) "The djadje ruled agenst him." MS Word corrects this to "The jade ruled agents him.", whereas Ginger automatically considers the context and corrects the sentence to "The judge ruled against him".
2) "Wer are you. You wer there. I wer my uniform". MS Word again mistakenly corrects this to "War are you. You war there. I war my uniform". Because Ginger understands context, it is able to get the correct word in each sentence: "Where are you. You were there. I wear my uniform."

Ginger is designed as a writing and learning platform. In addition to correcting the errors that users make Ginger also provides reports of the users' frequent errors over time. The reports contain statistical error analyses based on the users' work experience. The software also features a TTS component which allows users to listen to individual words, sentences or full texts. Ginger software works in MS Word, Outlook, PowerPoint, IE as well as Firefox.

It is worth noting that Ginger does not yield perfect accuracy. Any program, no matter how advanced, will always make mistakes while it lacks a human-level understanding of text. But it is unquestionably a new dawn in text correction.

To learn more about Ginger Software, please visit Ginger Software's website: www.gingersoftware.com

References
MacArthur, C. A., Graham, S., Haynes, J. B., & DeLaPaz, S. (1996). Spell checkers and students with learning disabilities: Performance comparisons and impact on spelling. Journal of Special Education, **30** , pp35-57.

About the author:
Sharon has over a decade of experience in the domain of Natural Language Processing (NLP) based products. She has an MSc in Speech and Language Processing and is currently writing up her doctorate thesis in the field of Computational Linguistics at the School of Informatics at Edinburgh University, Scotland.