Math-to-Text: Tips and Tools

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Abstract

It is challenging to provide speech-to-text services in math and science classes. Besides the often unfamiliar content of many math and science classes, there are the added challenges of quickly and clearly showing symbols and formulas. This paper will present a range of tools and techniques for meeting these challenges using the most popular types of speech-to-text software.

Special methods are needed to provide real-time speech-to-text services in math and science classes. Handwriting is too slow, and regular typing is unable to quickly produce the special symbols used in formulas and equations. In real-time communication access services, speed is critical. We will discuss ways of quickly typing math and science, especially when using the common speech-to-text software products.

Speech-to-text services in math and formula-intensive science classes often produce ambiguous or unreadable text. In text format, phrases such as "two pi r squared" or "x to the fifth plus two y to the third" may look like English, but in actuality math is indeed, as high school students have always known, a foreign language.

Furthermore, the language of math is a written language, and is "spoken" or translated into English according to agreed-upon conventions. We will use the term "mathlish" to refer to this spoken reading of written mathematics. When this spoken translation is then re-transliterated into printed text, the result can be confusing and may lack the meaning of the original math text.

Computer Math

Mathematicians and engineers have come up with conventions for typing math into scientific calculators and computers, which allow the user to key in common math symbols quickly, and which also increase the readability and decrease the ambiguity of the math. For example x^2 is used for x^2.

This approach does work. However, these conventions must be learned and are therefore less useful to a deaf or hard-of-hearing student, who in addition to learning the math taught by the instructor would also be required to learn a writing system that her/his classmates would generally not have to learn.

Here are some computer math examples:

Written "mathlish"	Computer math	Written math
2 pi r squared	2 pi r^2	$2\pi\ r^2$
x to the fifth + 2 y to the third	x^5 + 2y^3	$x^5 + 2y^3$
x to the fifth + 2y to the third	(x^5 + 2y)^3	$(x^5 + 2y)^3$
the square root of 9	root 9	$\sqrt{}\ 9$
3 times ten to the ninth	3 * 10^9	3×10^9
H2O2 + 2HCl	H2 O2 + 2HCl	H_2O_2 + 2HCl

The second and third examples above show possible ambiguity that can be introduced when only the spoken "mathlish" is attended to by the service provider.

Better-looking Math

To type math quickly, one must learn how to do two things. First, one must learn to locate special symbols like π and add them to the dictionary of one's speech-to-text software as an easy-to-type abbreviation. Second, one must learn the special commands for adding superscripts and subscripts. We will now discuss specific techniques to do these things using existing speech-to-text software.

Math mode

TypeWell V5 provides an easy way to type math quickly using its special "math mode" feature: Just turn on math mode and type the formula. For instance, type "2pi r2" to get $2\pi\ r^2$. Type "x5 + 2y3" to get $x^5 + 2y^3$. Type "3x109" to get $3\times10^{9.}$. Type "H2O2 + 2HCL" to get H_2O_2 + 2HCl.

The most important tip for TypeWell users is to be sure to read through the built-in tutorial, especially the Fields section about different areas of math and science. Also, the techniques discussed below for other systems will work with TypeWell. Start with the Lucida Sans Unicode font in Character Map for use with TypeWell. This can be useful when typing a rare symbol that may not be in TypeWell's built-in math dictionary.

Character Map (for all systems)

In all the common speech-to-text systems (including, for instance, the CART system Eclipse, speech recognition systems like NaturallySpeaking, TypeWell, and the newest C-Print software), you can add special characters to your dictionary. The key is to use the Character Map program that is built into Windows to locate the special symbol needed. Character Map works well once one learns its oddities, discussed below.

Character Map is on the All Programs/Accessories submenu, and may sometimes be within the System Tools submenu of that.

To find the desired character in Character Map, first choose an appropriate font from the drop-down list. Different fonts have different selections of characters. The fonts with Unicode in their names are the most likely to have rare and unusual characters.

Then, locate the character within the font. You can search for the character by name using the "Search for" field. For instance, type "gamma" in the search field and click Search to locate upper and lower-case Greek gamma characters. An oddity of Character Map is that you must click Reset before doing a second search.

Once you've located the desired character in Character Map, click on the character from the grid display and then click Select to put it into the clipboard. Paste the character into the appropriate box in your software for adding a dictionary entry. Another oddity of Character Map is that it includes a New Paragraph code in the clipboard after the desired character. You may want to first paste into text, then select and copy just the desired character without the New Paragraph.

After pasting the character into the dictionary, set it up with an abbreviation of your choice. For instance, you might use the abbreviation pisym to type π.

Superscripts (for all systems)

Some software includes a special keystroke to enter superscripts or subscripts. For instance, in C-Print use the ctrl up-arrow and ctrl down-arrow. Look in the software manual for your product to locate the superscript and subscript keystrokes.

Some products may have no way to enter superscripts and subscripts. All is not lost. The most commonly needed superscripts are a raised 2 for squared, and a raised 3 for cubed. These can be typed in most systems, such as in the CART Eclipse software, by using the special symbol techniques of the above section. Use Character Map to locate the raised 2 and raised 3 symbols, and add them to the dictionary. One could for instance use the abbreviation 2* in Eclipse to produce the raised 2.

Although these methods allow one to type superscripts and subscripts reasonably quickly, one might prefer to type x2 to get x^2, rather than x{ctrl-something}2{ctrl-something}. Speed is of the essence in real-time speech-to-text. One can achieve this to a certain degree by entering the most common polynomial terms into the abbreviation dictionary. Using the special raised-2 and raised-3 symbols above for instance, one can make the abbreviation x2 give x^2.

Conclusion

To summarize, by using certain techniques one can type many of the formulas and equations of math and science in most speech-to-text systems.

Captioning and transcribing in math and math-intensive courses requires preparation and awareness of the content that is being taught. We would like to warn service providers not to overdo the use of math symbols, but rather to keep in mind that the students are learning math via English, and that the way math is spoken is an important part of that learning process. However, with an introduction of basic math symbols into one's work, the resultant text will be much more readable and accurate than a straight transliteration of the instructor's spoken translation of the mathematics.

For more information, see <http://typewell.com/pepnet.htm>.