



# Musical patterns and computation

My current research is in the computational modelling and statistical analysis of musical patterns. It roughly means that we are trying to automatically find the interesting parts of music and how they relate to each other!

We look into classical, folk and artificially generated music data, and make use of algorithms from data mining, times series analysis, machine learning based clustering and classification algorithms, etc. We also look into how a special type of programming, functional programming, can help us in this process. My hope is to contribute to a computationally- and quantitatively-based understanding of music and algorithms.

Curious to see how music connects with information and computing sciences? Try to solve the example problems described below: Whether if you read sheet music or not, you should see some regularities in the following excerpt:

**Hello, my name is Iris Yuping Ren.** I'm a PhD candidate in the Interaction Technology group and the Software Technology group at the Department of Information and Computing Sciences. I have a background in Statistics, Complex System Science and Computer Engineering before I entered my PhD programme. I also love art, especially music, and hold a diploma in violin performance from Eastman Community Music School.



How many musical patterns could you find? How do the pattern occurrences relate to each other? How would you design a system to extract patterns like this?

# Answer!

**Pattern1:** Occurrence 1 Occurrence 2  
(with transposition -1)

**Pattern2:** Occurrence 1 Occurrence 2  
(with transposition +2)

There are multiple answers! But most people will probably spot that the first bar is a pattern that is repeated many times in similar forms. In contrast, the ascending scale is another pattern, very different from the first pattern, but also repeated in another form.

The “music” above has been generated artificially to make the music stand out more. In the simplest way, one can take the first occurrence and apply the function  $f(x) = x-1$  in combination to retrieve the occurrences from the first pattern,  $f(x) = x+2$  for the second!

Now, how about this one? There are more sophisticated algorithms out there to explore!

If you could take a photo of the patterns you found (and a short description of why you find them to be patterns) and send it to [y.ren@uu.nl](mailto:y.ren@uu.nl), we would really appreciate it!

This handout has been created by WICS ([wics.sites.uu.nl](http://wics.sites.uu.nl)), the women’s network of the Department of Information and Computing Sciences, and WIT, the Women in IT group of student association Sticky ([svsticky.nl](http://svsticky.nl)).

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