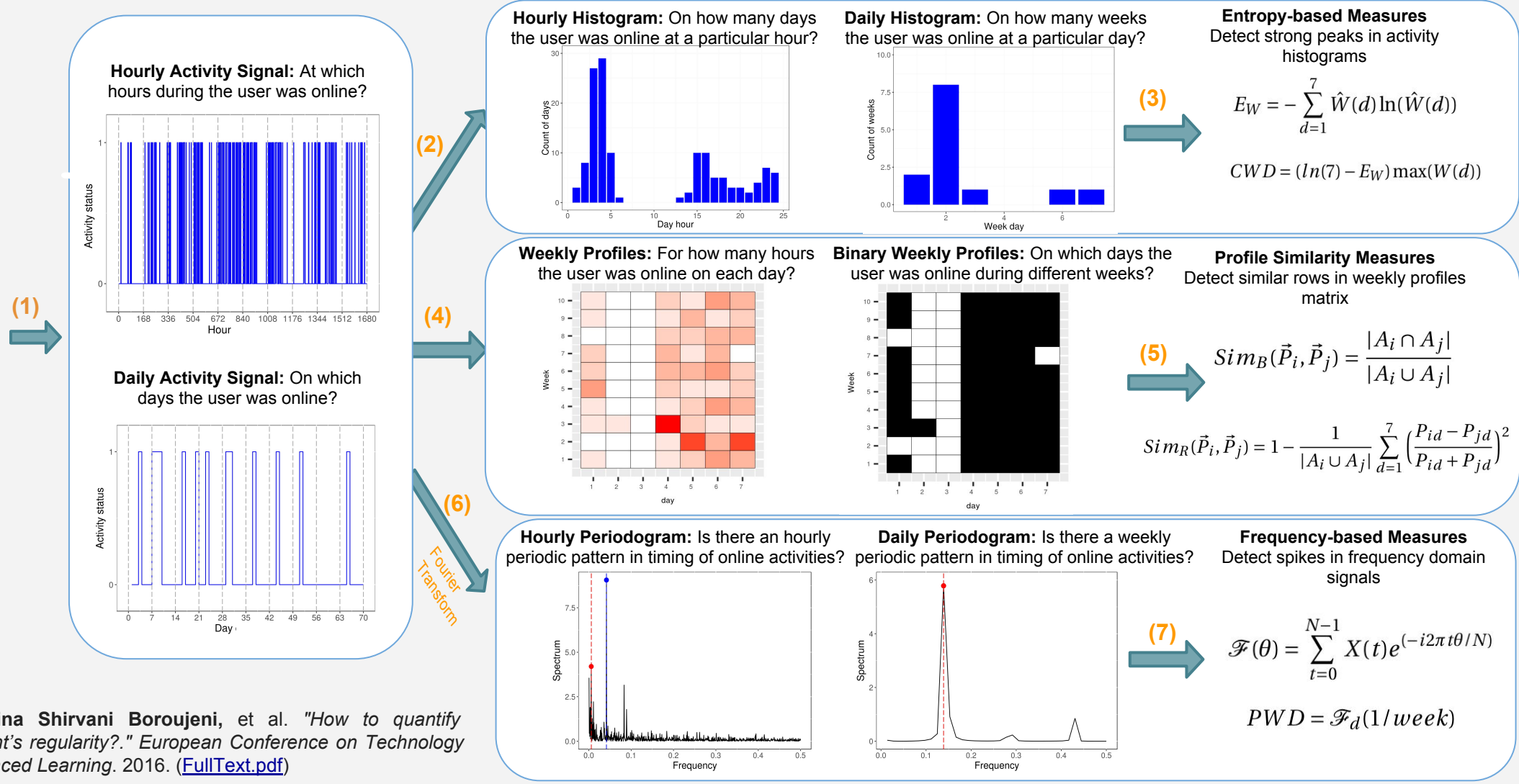


Time Series Analysis: Detecting and Quantifying Temporal Patterns in Online Interactions

Quantifying regularity is the main objective of this work. We introduce methods to detect repeating patterns in timing of user's activities in a weekly or a daily basis. Given the set of timestamp of user's activities, (1) we binarize the activity sequence of the user to represent when (s)he was online during a certain period. We then introduce three sets of regularity measure. **In the first approach, (2)** we collapse the binary activity signals into hourly/daily histograms. If user's activities are concentrated around a particular weekday/hour, this would emerge as a peak in the corresponding histogram. **(3)** To detect such patterns we propose entropy-based measures. **In the second approach, (4)** we build weekly profiles, which show for how many hours the user was online at a certain day in each week. If the user has a certain weekly time schedule, this would appear as similar rows in the weekly profiles. **(5)** To detect this pattern, we propose weekly similarity measures. **In the third approach, (6)** we apply fourier transform on the binary activity signals to obtain its frequency-domain representation (periodogram). A periodic pattern in user's activity signal, would appear as a spike in the periodogram at the corresponding frequency **(7)** We introduce frequency-based measures to capture such patterns.

Results: We applied the proposed methods to quantify regularity level of over 10,000 learners in a MOOC course and showed that regularity is a predictor of achievement level. The introduced measure are applicable in different contexts and online platforms and reflect the predictability of users interaction patterns [*].

Activities Timestamps
{t1, t2, t3, ..., tn}



[*] Mina Shirvani Boroujeni, et al. "How to quantify student's regularity?." European Conference on Technology Enhanced Learning. 2016. ([FullText.pdf](#))