

and all the COPD severity classes (both weekdays and weekend days). For R3 statistical differences ($p < 0.0001$) were also found between the first two stage of the disease (GOLD1, GOLD2) and the last two stages (GOLD3 and GOLD4) during the weekdays. For the weekend, only between GOLD1 and the last two stage of disease (GOLD3 GOLD4) and between GOLD2 and GOLD4. For R12, statistical differences ($p < 0.0001$) have been found between healthy subject and GOLD2, GOLD3, GOLD4 (both weekdays and weekend days). Between the GOLD1 and GOLD3–4 (also during the weekend days), between GOLD2 and GOLD4 (also weekend).

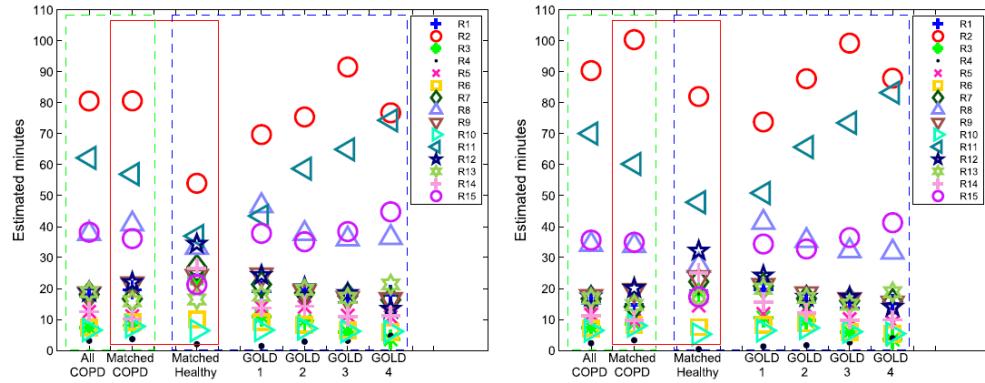


Figure 41 Activation topic averages during weekdays (left) and weekend days (right). The green dashed rectangles indicate the comparison between all the COPD patients ($n = 977$), and the COPD subset used to generate the routines ($n = 66$). The red rectangles indicate the comparison between the matched COPD patients ($n = 66$) and the matched healthy subjects ($n = 66$). The dashed blue rectangles indicate the comparison between the healthy subjects ($n = 66$), GOLD1 ($n = 89$), GOLD2 ($n = 385$), GOLD3 ($n = 330$), and GOLD4 ($n = 173$). Inference was performed in the first 6 h after the awakenings from the night sleep.

6.5.4 Discriminatory power of routines

In order to further validate the findings shown in Figure 41 and assess the discriminatory power of PA routines, we first clustered the 66 *patient:control* matches and, subsequently, their assessed weekdays. For the first clustering experiment, each of the 66 healthy subjects and 66 matching COPD patients was represented by the average time spent in each routine over the assessed weekdays as symbolically shown in the star plots of Figure 40. Distance-based features were extracted using only R3, R12, and R14 because of their correlation with the FEV1, %predicted and FEV₁ : variables used to assess airway obstruction in the current clinical setting. In particular, we calculated the pairwise Kullback–Leibler pairwise distances between all the subjects represented by the averaged time spent in R3, R12, and R14. Using Kruskal's normalized stress1 criterion, we created a set of locations in three dimensions whose interpoint distances approximate the routine dissimilarities between subjects. We finally clustered the subjects such represented using a k-mean clustering algorithm with $k = 2$ achieving 86% accuracy in dividing the two groups. For the second experiment, we clustered the 536 assessed weekdays (273 for healthy subjects, 263 for COPD patients), which were represented by the associated daily time spent by the subjects in R3, R12, R14. After extracting the same typology of features, we clustered the days in $k = 2$ groups achieving 82% of accuracy in discriminating between days that belong to healthy subjects and days belonging to COPD patients. This shows that activity