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A compass towards equity: a data analysis framework to capture children's behaviour in the playground context

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Summary

Playgrounds help children develop essential physical and social skills through playing and socializing with their peers and supervisors. However, playgrounds may also include obstacles that hinder children's development, specifically for those with communication difficulties. Addressing these challenges requires a deep understanding of children's needs in playground settings.

By adopting wearable sensing technology, we aimed to design a data analysis framework and deepen our knowledge of children's behavior in playgrounds. Developing a practical playground analysis framework requires addressing three main characteristics of playgrounds: multiple interconnected environments, differences in individual experiences, and spatio-temporal dynamics. Through various research questions, we have addressed these features as follows.

- **Feature 1: Multiple Environments.**

In playgrounds, children interact with three interconnected environments: physical environment, social environment, and cultural environment. To incorporate these multiple environments in our data analysis framework, we used modern sensing technologies, i.e., proximity tags, GPS loggers, and accelerometers, to capture children's behavior in schoolyards. This method further enabled us to identify three affordances, i.e., physical, social, and cultural, which a child interacts with according to its capacities and needs, i.e., effectivities. We further developed a spatio-temporal metric that measures the impact of the physical environment on children's social networks in the playground context.

- **Feature 2: Individual Experiences.**

Children have different capacities and needs in their interactions with their environments. We specifically studied these differences in individual experiences by focusing on children with and without autism. Individual experiences

are included through self-report data and peer nomination reports alongside sensor measurements to obtain children's perspectives on their behavior in playgrounds. Our results show the importance of addressing differences in effectivities either at the group level or at the individual level in relation to the affordances of the environment.

- **Feature 3: Spatio-temporal Dynamics.**

Children's activities constantly change in playgrounds during play. Analyzing these spatio-temporal dynamics enables a deeper understanding of children's behavior in their social environment. We specifically focused on capturing complex interactions beyond face-to-face contact by utilizing artificial intelligence models to model group behavior. Our proposed method identifies group behaviors using spatio-temporal data in constrained environments such as university campuses or schoolyards.

The present dissertation integrates cutting-edge technological advancements with multidisciplinary collaboration to design a framework for analyzing children's behavior in playgrounds. This framework offers stakeholders a valuable tool for analyzing individual and group-level challenges in micro-communities, such as schoolyards, nursing homes, and sports clubs.