Advancing Human Behavior Sensing in On-Demand Delivery and Smart Cities through Pre-trained Models and Citizen Science Approaches

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Abstract

The convergence of human behavior sensing technologies with smart city infrastructure is increasingly vital to meet the evolving needs of urban environments, particularly in areas such as on-demand delivery services. My recent research focuses on utilizing advanced sensing techniques, data mining, and machine learning to monitor and analyze human behavior in these dynamic settings [1–3]. The ability to accurately recognize patterns in human movement, activities, and decision-making is crucial for enhancing the efficiency and sustainability of urban logistics, improving public services, and creating safer, more responsive urban spaces.

A central element of my work involves smartphone-based sensing, where data from mobile devices, such as GPS, accelerometers, and other embedded sensors, can be leveraged to gain insights into human actions in real-time. This approach offers unique advantages in terms of accessibility and scalability, as smartphones are widely used and can provide continuous streams of rich data. However, integrating this data into actionable insights requires robust computational techniques, particularly in real-world environments that introduce noise, variability, and uncertainty.

To address these challenges, I have explored using pre-trained models like ChatGPT to enhance human behavior recognition systems. While traditionally used for natural language processing, models like ChatGPT have demonstrated significant potential for interpreting complex data patterns beyond text. By fine-tuning these models for specific sensing tasks, we can improve their ability to interpret diverse sensor data streams, extract meaningful patterns, and make predictions about human behavior in urban contexts.

One of the primary applications of my research has been in the field of on-demand delivery, where understanding driver and customer behavior is critical for optimizing operations. By analyzing real-time sensor data, including GPS trajectories and smartphone sensor readings, we can model delivery worker behavior to enhance route planning, predict delays, and improve overall efficiency. This type of behavior recognition also has important implications for safety, enabling the detection of fatigue or risky behaviors, thus reducing accidents and improving working conditions.

In addition to delivery systems, my research extends to smart cities, where human behavior sensing plays a pivotal role in optimizing urban mobility, energy use, and public safety. By embedding behavior recognition systems into smart city infrastructure, we can better understand how people interact with urban environments, including public transportation systems, roads, and public spaces. These insights can inform city planners and policymakers, helping them design cities that are more adaptive, efficient, and resilient.

One of the key challenges in this field is the cost and complexity of deploying large-scale sensor networks. To address this, my research aligns with the theme of "Enabling Citizen Science through Low-cost Sensor Development and Use." I aim to democratize access to human behavior sensing technologies by leveraging existing consumer-grade devices, such as smartphones and wearable sensors, which can be used by citizens themselves to collect valuable data. This citizen science approach not only reduces the cost of data collection but also empowers individuals and communities to contribute to the development of smarter, more sustainable cities.

In addition to the technological aspects, I am also deeply interested in the ethical considerations of human behavior sensing. Issues related to privacy, data ownership, and consent are critical when developing systems that monitor and analyze individual behavior. My work emphasizes the importance of creating transparent, accountable systems that safeguard user privacy while still enabling the rich insights that human behavior sensing can provide. By developing privacy-preserving data collection methods and ensuring that users are informed and in control of their data, we can build more ethical and trustworthy sensing systems.

The use of pre-trained models like ChatGPT also opens up new opportunities for "Human-Computer Teaming," another key theme of this workshop. In a human-computer teaming context, AI models can work alongside human operators to enhance decision-making in real-time. For instance, in the context of urban delivery, AI systems could analyze sensor data to suggest optimal routes or detect potential problems, while human operators provide oversight and contextual understanding. This type of collaboration between humans and AI offers significant potential for improving the scalability and efficiency of human behavior sensing systems.

Looking ahead, I see several exciting avenues for future research. One area of interest is the integration of multi-modal sensing data, combining information from various sources, such as smartphones, environmental sensors, and social media, to create a more comprehensive understanding of human behavior. Another promising direction is the application of reinforcement learning techniques to human behavior sensing, where AI systems can learn from real-time feedback and adapt their behavior models accordingly.

In conclusion, my research aims to advance the field of human behavior sensing by exploring innovative applications in on-demand delivery and smart cities, leveraging pre-trained models like ChatGPT, and aligning with key themes of this workshop, including "Human-Computer Teaming" and "Enabling Citizen Science through Low-cost Sensor Development and Use." I look forward to participating in the workshop and collaborating with other researchers and practitioners to push the boundaries of what is possible in human behavior sensing and smart city development.

References Cited

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