A Social Media Analysis of the Prevalence of COVID-19 on Public Transit Ridership in the United States

Likhitha Yelamanchili
Department of Computer Science
San Jose State University
San Jose, CA 95192, USA
likhitha.yelamanchili@sjsu.edu

Egbe-Etu Etu, PhD
Department of Marketing & Business Analytics
San Jose State University
San Jose, CA 95192, USA
egbe-etu.etu@sjsu.edu

Lin Jiang, PhD
Department of Mechanical Engineering
San Jose State University
San Jose, CA 95192, USA
lin.jian@sjsu.edu

Imokhai Tenebe, PhD
Software Engineer
Westerville, OH 43081, USA
yoshearer@gmail.com

Onome Edo
Department of Information Systems
Auburn University at Montgomery
Montgomery, AL 36117, USA
chrisovik@gmail.com

Abstract

In the U.S. public transit ridership in 2020 declined by 79% compared to 2019 levels at the start of the pandemic. With lockdowns implemented during the early days of the pandemic, direct human-to-human interactions migrated to virtual platforms. This study investigates the public's perception of transit systems via a social media analysis, given the advent of vaccines and other COVID-19 preventive measures. We developed a structured topic modeling tweet analytics (Twilytics) framework to analyze public discourse data (i.e., tweets from 2020 to 2021) on the impact of COVID-19 on transit systems. The framework has four main components: first, we extracted the tweets starting from June 2020 to November 2021. Second, we pre-processed and cleaned the data. Third, we performed statistical analysis on the cleaned data. Lastly, we performed topic modeling (TM) using a Latent Dirichlet Allocation approach to reduce the dimensionality of our textual data and uncover the prominent themes of the public's perception of transit systems during the pandemic. We extracted 44,320 tweets related to public transit in the US within the study period. On average, 2020 had 113 transit-related tweets per month, while 2021 had 59.81. In addition, categorizing the tweets resulted in four main themes: transit and social distancing, travel bans, airlines, and vaccinations. Kruskal-Wallis's analysis of variance test results showed a statistically significant difference ($p < 0.05$) in the number of transit-related

tweets per month and day. The TM findings revealed themes constituting fear and confusion about using public transport, preference for private transport, and bicycles over public transit during the first year of the pandemic. The public had doubts on how the vaccines will impact transportation and movement throughout 2021, with most users concerned about the influence of the variants. Transport managers and city planners can use this framework as a decision-making tool to enable a holistic understanding of public opinions on transportation services and formulate policies for a safe reopening.

Keywords
Social Media Analysis, COVID-19, Transportation, Topic Modeling, and Twitter.

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Biographies
Likhitha Yelamanchili is a graduate student majoring in M.S. Computer Science at San Jose State University. She received her Bachelor of Technology in Computer Science from the Gayatri Vidya Parishad College of Engineering (Autonomous), India, in 2019. Her research interests include machine learning, big data, and artificial intelligence. Likhitha also enjoys developing web applications.

Egbe-Etu Etu, Ph.D., is an Assistant Professor of Business Analytics at San Jose State University (SJSU). He is also a Research Associate at the Mineta Transportation Institute. Before joining SJSU, Dr. Etu received his Ph.D. in Industrial and Systems Engineering from Wayne State University, Detroit, in 2021 and his bachelor's degree in Civil Engineering from Covenant University, Nigeria, in 2016. His research interest centers on developing use-inspired machine learning models to solve challenging business problems in healthcare, manufacturing, and transportation. He is a member of the Industrial Engineering and Operations Management (IEOM), Institute of Industrial & Systems Engineering (IISE), and SAVE International.

Imokhai Tenebe, Ph.D., is currently a Software Engineer. Previously, he was a Safety Engineer with the Texas Commission on Environmental Quality in Austin, Texas, and participated in research at Texas State University, San Marcos, Texas. He obtained his Ph.D. in Water Resources and Environmental Engineering and has two masters in the same area of expertise from Nigeria and the United States. He has published over 80 articles on several subjects with interest in water resources, healthcare, pollution, transportation, and data science.

Lin Jiang, Ph.D., is an Assistant Professor of Mechanical Engineering at San Jose State University. Her research focuses on human biomechanics and robotics, particularly on assistive technology medical devices. Her work has been published in IEEE Transactions on Biomedical Engineering (TBME), Annuals of Biomedical Engineering (ABME), IEEE Robotics and Automation Letters (RAL), Journal of Biomedical Engineering (JBME), and others. She is also an active member of IEEE HKN, BMES, ASME, and ISHRML. Dr. Jiang received Professional Developmental Fund from the college of engineering at SJSU, Exemplary Teaching award from the school of engineering at UT Dallas, Diversity Award from Summer Biomechanics, Bioengineering and Biotransport Conference, Best paper award from 2018 ASME IMECE conference, among others.

Onome Edo is a graduate student majoring in M.S. Management and Information Science at Auburn University at Montgomery. He received his first and second degrees in accounting from Ambrose Ali University, Ekpoma, and the University of Benin, Nigeria. He has authored six peer-reviewed articles focusing on health information systems, technology adoption, environmental sustainability, and green field investment. He is currently working on completing his thesis on healthcare information technology adoption in Africa.