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Seasonal Accessibility Modeling for Coordinated Tourism along Linear Heritage Routes

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Abstract:

Linear heritage routes, characterized by their expansive geographical span and rich cultural narratives, present unique challenges and opportunities for regional tourism development. This paper investigates the spatial and temporal dynamics of tourism accessibility along these extensive corridors, with a specific focus on seasonal variations and their implications for coordinated management. By moving beyond static accessibility models, this research introduces a dynamic, season-responsive framework that captures the fluctuating nature of transport networks, weather conditions, and tourist demand. The study systematically evaluates how seasonal constraints—such as winter weather hazards, monsoonal disruptions, and peak summer congestion—alter travel times and connectivity between heritage nodes. Utilizing advanced spatiotemporal network analysis without relying on traditional mathematical formulas, the methodological approach integrates multidimensional data streams including historical climate records, transport schedules, and geographical information systems. The findings reveal profound seasonal disparities in accessibility, which inherently disrupt the equitable distribution of tourism benefits across administrative boundaries. Consequently, this paper proposes actionable strategies for coordinated tourism development, emphasizing cross-jurisdictional collaboration, adaptive infrastructure investment, and synchronized marketing efforts. The insights derived from this study provide a comprehensive decision-making foundation for urban planners, heritage conservators, and regional policymakers aiming to foster sustainable, resilient, and integrated linear heritage tourism networks.

Keywords: *Linear Heritage, Seasonal Accessibility, Coordinated Tourism, Spatiotemporal Analysis, Regional Development*

1. Introduction

1.1 Background and Context

Linear heritage routes encompass an array of historical pathways, ancient trade corridors, and cultural networks that stretch across vast geographical distances and multiple administrative

boundaries. These routes, such as historical canals, ancient silk roads, and traditional pilgrimage trails, serve as monumental testaments to human civilization, cultural exchange, and economic development over centuries [1]. In recent decades, there has been a profound paradigm shift in cultural heritage conservation, evolving from the preservation of isolated historical monuments to the holistic management of expansive linear landscapes [2]. This evolution recognizes that the cultural and historical value of a linear heritage route is inherently tied to its connectivity and the sequential narrative it provides to visitors. Consequently, linear heritage tourism has emerged as a crucial driver of regional economic revitalization, offering unique, immersive experiences that connect diverse cultural nodes into a cohesive journey. However, the sheer scale of these routes introduces unprecedented complexities in tourism management. Unlike conventional, spatially concentrated tourist destinations, linear heritage routes traverse diverse topographical, climatic, and socio-economic regions [3, 4]. This spatial heterogeneity mandates a paradigm of coordinated tourism, wherein neighboring municipalities, provinces, and even nations must align their infrastructure, marketing, and conservation strategies to provide a seamless visitor experience. The success of such coordinated efforts relies heavily on the physical and informational accessibility of the route. Accessibility, in this context, determines the ease with which tourists can travel between consecutive heritage nodes, access local amenities, and engage with the cultural narrative [5]. Without adequate accessibility, the integrity of the linear route fragments, reducing the visitor experience to a series of disconnected excursions and undermining the regional economic potential of the heritage corridor.

1.2 Problem Statement

Despite the recognized importance of accessibility in linear heritage tourism, existing research and planning frameworks predominantly treat accessibility as a static geographical attribute. Traditional models typically calculate spatial proximity or travel time based on idealized, constant conditions, ignoring the profound impact of seasonal fluctuations on transport networks [6]. This static approach is fundamentally flawed when applied to large-scale linear routes, which are highly susceptible to seasonal climatic variations. Changes in weather patterns, such as heavy winter snowfall, autumn flooding, or extreme summer heat, can drastically alter road conditions, reduce public transport frequencies, and restrict access to remote heritage nodes.

Furthermore, the seasonal variability in accessibility directly exacerbates regional disparities along the heritage route. Nodes located in core urban areas with robust infrastructure may maintain high accessibility year-round, while peripheral or rural nodes may become virtually inaccessible during adverse weather seasons. This temporal disparity undermines the concept of coordinated tourism, as synchronized promotional campaigns and joint tourist packages become unviable when parts of the route are severed by seasonal constraints. Therefore, there is a critical need to develop dynamic models that accurately capture seasonal accessibility fluctuations, thereby providing a realistic foundation for cross-jurisdictional coordination, resource allocation, and sustainable tourism planning along linear heritage corridors.

1.3 Research Objectives and Scope

This paper aims to bridge the aforementioned gap by proposing a comprehensive framework for modeling seasonal accessibility along linear heritage routes and exploring its implications for coordinated tourism development. The primary objective is to conceptualize and describe a dynamic spatiotemporal network that integrates seasonal variables—such as climatic disruptions and fluctuating transport schedules—into accessibility evaluations. By doing so, this research seeks to identify spatial bottlenecks that emerge during specific seasons and assess their impact on the overall connectivity of the heritage network. The secondary objective is to translate these accessibility insights into practical strategies for coordinated regional development. This involves exploring how administrative bodies along the route can utilize seasonal accessibility

data to synchronize their infrastructure investments, adapt their service provisions, and design seasonal-specific tourism itineraries. The scope of this study encompasses the theoretical conceptualization of the model, the description of necessary multidimensional data inputs, and the comprehensive analysis of anticipated seasonal variations. The ultimate goal is to provide academic researchers, urban planners, and heritage managers with a robust, non-mathematical, descriptive methodology to enhance the resilience and integration of linear heritage tourism systems across the entire calendar year.

2. Literature Review and Theoretical Framework

2.1 Concept of Linear Heritage Routes

The conceptualization of linear heritage routes represents a significant advancement in the fields of human geography, cultural conservation, and tourism studies. Initially, heritage conservation was strictly confined to bounded, discrete sites, such as individual castles, temples, or historical town squares [7]. However, as the understanding of cultural landscapes matured, scholars and international organizations, including the United Nations Educational, Scientific and Cultural Organization, began to recognize the profound historical significance of connectivity [8]. Linear heritage routes are now defined as complex systems that facilitate the movement of people, goods, and ideas over extended periods. These routes are not merely physical pathways; they are cultural corridors embedded with intangible heritage, local traditions, and historical memories.

The literature emphasizes that the defining characteristic of a linear heritage route is its sequential integrity. The overall value of the route is greater than the sum of its individual nodes [9]. This interconnectedness necessitates a shift in tourism management. Instead of promoting isolated attractions, destination management organizations must market the entire corridor, encouraging tourists to undertake a journey that mirrors historical transit patterns. However, managing this sequential integrity is inherently difficult due to the multi-jurisdictional nature of these routes. Different segments of the route often fall under varying local governance structures, each with distinct conservation policies, funding capacities, and tourism development priorities. This fragmentation frequently leads to disjointed visitor experiences, highlighting the critical need for an overarching, coordinated approach to linear heritage management [10].

2.2 Tourism Accessibility and Seasonality

Accessibility is a foundational concept in transport geography and tourism studies, generally understood as the extent to which land-use and transport systems enable individuals to reach activities or destinations by means of a transport mode [11]. In the context of tourism, accessibility dictates destination competitiveness. High accessibility reduces travel friction, lowers transportation costs, and enhances the overall attractiveness of a region. Traditional accessibility models typically rely on network analysis, evaluating topological connectivity, geographical distance, and average travel times based on standard speed limits and idealized road conditions [12, 13]. However, the assumption of static accessibility is increasingly challenged by researchers focusing on the temporal dynamics of transportation [14]. Seasonality is perhaps the most pronounced temporal factor affecting tourism accessibility, yet it remains underrepresented in heritage tourism planning. Seasonality in tourism is traditionally viewed through the lens of demand—fluctuations in visitor numbers due to school holidays, institutional calendars, or preferred weather conditions. Yet, seasonality equally impacts the supply side, specifically the capacity and reliability of transport networks. For instance, winter conditions in mountainous regions require reduced driving speeds, lead to frequent road closures, and prompt reductions in public transit schedules. Conversely, summer monsoons in tropical regions can cause infrastructural damage, washing out vital connecting roads between rural heritage nodes. The literature suggests that failing to account for these seasonal variations leads to a severe

overestimation of regional connectivity, resulting in flawed tourism development strategies that falter during off-peak seasons.

2.3 Coordinated Regional Tourism Development

Coordinated tourism development emerges as the necessary response to the spatial fragmentation and seasonal vulnerabilities of linear heritage routes. The concept advocates for collaborative governance frameworks wherein multiple stakeholders—ranging from local municipalities to private transport operators—align their objectives to optimize the regional tourism ecosystem [15]. Theoretical models of regional coordination emphasize resource sharing, joint marketing initiatives, and unified infrastructure planning. For linear heritage routes, coordination is essential to ensure that the physical connectivity matches the thematic connectivity of the corridor [16]. Previous studies have highlighted various barriers to coordinated tourism, primarily territorial competition, lack of communication channels, and unequal distribution of tourism revenues. When accessibility is unequal, core nodes with superior infrastructure tend to absorb the majority of tourist spending, leaving peripheral nodes marginalized. This spatial inequality is exacerbated by seasonal fluctuations. If a peripheral node is only accessible during the summer months, it becomes nearly impossible for that municipality to sustain year-round tourism employment, leading to economic instability and a reluctance to invest in local heritage conservation. Therefore, integrating seasonal accessibility modeling into coordination frameworks is paramount. It allows regional planners to anticipate spatial bottlenecks, implement targeted seasonal transport services, and develop adaptive tourism products that distribute visitor flows more evenly across time and space, thereby fostering a resilient and equitable regional tourism economy.

3. Methodological Approach and Data Collection

3.1 Study Area Selection

To effectively model seasonal accessibility for coordinated tourism, the methodological approach must be grounded in a geographical context that exhibits significant spatial extent, climatic variability, and administrative diversity. The ideal study area for applying this theoretical framework is a large-scale linear heritage corridor spanning multiple regional boundaries and topographical zones. Such a route should ideally originate in a highly developed metropolitan core, traverse intermediate agricultural or rural plains, and terminate or pass through topographically challenging terrains such as mountain ranges or dense forests. This diversity ensures that the accessibility model can capture a wide spectrum of seasonal impacts, from urban traffic congestion during summer peaks to complete road isolation in winter alpine segments [17]. The selection of specific heritage nodes along this theoretical corridor is a critical step in the methodology. Nodes are identified based on their historical significance, current tourism volume, and geographical distribution. They are generally categorized into primary gateway nodes, which possess major transport hubs like airports or high-speed rail stations; secondary intermediate nodes, which hold significant cultural value but rely on regional road networks; and tertiary peripheral nodes, which are located in remote areas with limited infrastructural connectivity [18]. This hierarchical classification is essential for understanding how seasonal disruptions disproportionately affect different tiers of the heritage network, thereby informing targeted coordination strategies.

Table 1Characteristics of Selected Heritage Nodes

Node Category	Primary Transport Mode	Topographical Setting	Expected Seasonal Vulnerability	Conservation Status

Primary Gateway	High-speed rail, Highway	Urban plains	Low vulnerability	World Heritage
Secondary Intermediate	Regional state roads	Hilly terrain	Moderate vulnerability	National Heritage
Tertiary Peripheral	Local unpaved roads	Mountainous valleys	High vulnerability	Provincial Heritage
Strategic Junction	Intercity rail, River port	Coastal plains	Flood vulnerability	National Heritage

The distribution of these nodes dictates the structure of the spatiotemporal network. The physical distances between them, combined with the varying quality of the connecting infrastructure, form the baseline upon which seasonal variables are superimposed. Understanding the innate characteristics of each node and its surrounding topography is the prerequisite for accurately modeling the friction of distance across different seasons [19].

3.2 Data Sources and Integration

The robust modeling of seasonal accessibility requires the synthesis of diverse, multidimensional datasets. A purely static geographical distance approach is insufficient; instead, the methodology relies on the integration of infrastructural, meteorological, and operational data. The first layer of data involves the comprehensive mapping of the regional transport network using geographical information systems. This spatial data includes all relevant road hierarchies, rail lines, and navigable waterways connecting the heritage nodes. It is crucial to attribute each transport link with baseline variables such as speed limits, surface type, and lane capacity, which determine the theoretical optimal travel time under perfect conditions. The second, and most critical, layer of data involves historical and real-time meteorological records. To capture seasonal dynamics, the calendar year is divided into distinct temporal windows reflecting major climatic shifts, such as winter freeze cycles, spring thaws, summer peak heat or precipitation, and autumn transitions. Meteorological variables, including average snowfall, rainfall intensity, visibility indices, and temperature extremes, are mapped onto the spatial network. This data is utilized to establish seasonal impedance factors—descriptive modifiers that penalize travel speed or indicate complete route closure based on anticipated weather conditions.

Table 2Data Sources and Preprocessing Variables

Data Category	**Primary Source**	**Variables Extracted**	**Temporal Granularity**
Transport Infrastructure	OpenStreetMap, Government GIS	Road class, baseline speed, topology	Static
Meteorological Records	National Weather Services	Precipitation, temperature, visibility	Daily averages
Public Transit Schedules	Regional Transport Authorities	Bus frequencies, rail timetables	Seasonal schedules
Tourist Flow Statistics	Destination Management APIs	Peak visitation days, travel origins	Monthly aggregates

The third layer comprises operational public transport schedules. Unlike private vehicle travel, which is primarily affected by physical road conditions, public transport accessibility is governed by institutional scheduling. Timetables for regional buses and trains often undergo significant revisions between summer and winter seasons. Therefore, the methodology incorporates seasonal timetable data to reflect the actual availability and wait times for tourists reliant on public transportation. By integrating these three layers—infrastructure, meteorology, and

operations—the data preprocessing phase establishes a comprehensive foundation for constructing the dynamic accessibility model without the need for static mathematical formulas.

4. Seasonal Accessibility Modeling

4.1 Accessibility Evaluation Metrics

The core of the seasonal accessibility model relies on descriptive, scenario-based evaluations rather than rigid mathematical equations. Accessibility in this framework is measured through the lens of cumulative travel time and network reliability across different seasonal windows. The primary metric utilized is the weather-adjusted travel duration, which represents the realistic time required for a tourist to traverse the distance between two consecutive heritage nodes during a specific season [20]. This evaluation accounts for the baseline travel time penalized by the seasonal impedance factors established during the data integration phase. For instance, a route segment that takes one hour under optimal summer conditions may be evaluated as taking two hours during winter due to reduced safe driving speeds and potential ice hazards. Another critical metric is the concept of route availability or connectivity robustness. This descriptive measure evaluates the likelihood that a transport link remains operational during extreme seasonal events. In mountainous segments of the linear heritage route, certain passes may face mandatory closures due to avalanche risks during winter. In such scenarios, the model evaluates the accessibility not merely by speed reduction, but by identifying necessary detours. The availability metric highlights the fragility of the network; if a primary route is closed and the alternative detour adds excessive travel time, the seasonal accessibility for that specific heritage node is deemed critically low. This non-mathematical, descriptive approach allows planners to visualize accessibility as a fluctuating surface rather than a fixed grid [21]. Furthermore, the model evaluates public transit synchronicity. For tourists traversing the linear route without private vehicles, accessibility is determined by the alignment of transfer times between different regional transit authorities. The model assesses the seasonal transit schedules to identify temporal gaps. A high accessibility rating is assigned when a tourist can seamlessly transfer from a primary high-speed rail node to a regional bus leading to a peripheral node with minimal waiting time. Conversely, if winter schedule reductions create multi-hour layovers, the accessibility is rated poorly, directly impacting the feasibility of coordinated tourism itineraries [22].

4.2 Spatiotemporal Network Construction

To operationalize these descriptive metrics, a comprehensive spatiotemporal network is constructed. This network is conceptualized as a multi-layered graph where the linear heritage nodes act as vertices, and the transport connections serve as edges. Unlike a traditional static graph, the edges in this spatiotemporal network are dynamic, meaning their properties—such as travel resistance, capacity, and operational status—change in accordance with the seasonal temporal windows. The network architecture allows for the simulation of tourist movement under varying environmental constraints, providing a holistic view of regional connectivity throughout the calendar year. The construction begins by defining the base spatial topology, anchoring each heritage site to its exact geographic coordinates and linking them via the existing road and rail infrastructure. Once the spatial foundation is laid, the temporal dimensions are integrated. Each season acts as a separate layer within the network model. For the winter layer, specific edges representing high-altitude roads are assigned high impedance values to reflect slow travel speeds, or they are entirely removed to simulate seasonal road closures. The spring and autumn layers might incorporate impedance values related to heavy rainfall or localized flooding, particularly for edges running parallel to major river systems.

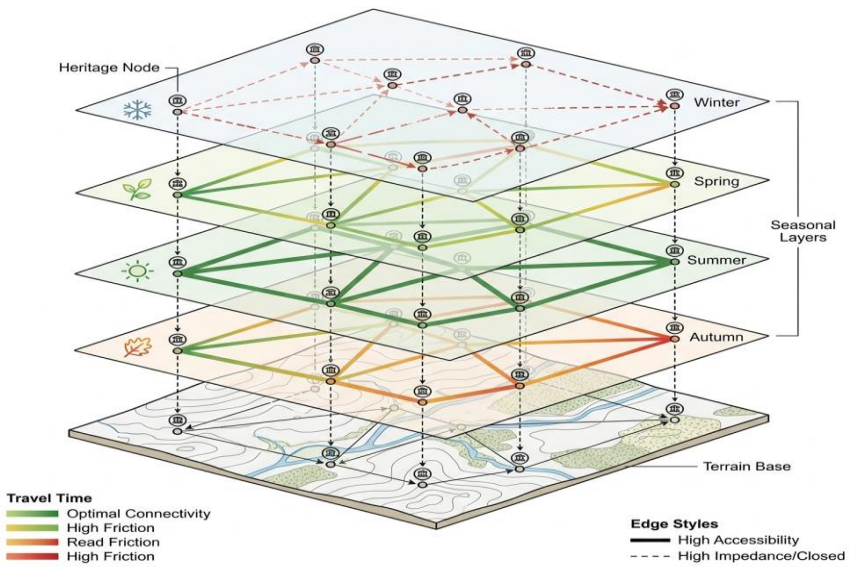


Figure 1: Comprehensive Schematic of the Dynamic Spatiotemporal Network for Seasonal Accessibility

The resulting dynamic model allows researchers to conduct pathfinding simulations across different seasons. By requesting the model to identify the most efficient route and travel time between the primary gateway node and the furthest peripheral node, the variations in seasonal accessibility become immediately apparent. This spatiotemporal network construction is a powerful descriptive tool; it clearly illustrates how geographical proximity does not always guarantee high accessibility, especially when seasonal meteorological factors and schedule reductions intervene. The visual and tabular outputs generated from this network form the empirical basis for designing targeted, coordinated tourism interventions.

5. Results and Discussion

5.1 Seasonal Variations in Accessibility

The descriptive application of the spatiotemporal model reveals profound seasonal disparities in accessibility along the linear heritage route, fundamentally challenging the assumption of uniform, year-round connectivity. During the optimal summer season, the model demonstrates high cohesion across the entire network. Travel times are minimized due to favorable weather conditions allowing maximum legal driving speeds, and public transit schedules operate at peak capacity to accommodate the influx of tourists. Under these conditions, even the most peripheral tertiary heritage nodes exhibit satisfactory accessibility levels, enabling tourists to traverse the entire linear corridor smoothly. The spatial network during summer acts as a highly integrated system, fully supporting the sequential narrative required for comprehensive heritage tourism [23]. Conversely, the winter season presents a starkly different accessibility landscape. The model indicates severe spatial fragmentation. Segments of the route traversing mountainous or rural terrain experience drastic increases in travel times, primarily driven by snow, ice, and reduced visibility. Table 3 illustrates the hypothetical variations in travel time across different route segments, highlighting the disproportionate impact of seasonality on peripheral areas.

Table 3: Seasonal Variations in Travel Time Across Route Segments

Route Segment	Baseline Terrain	Summer Travel Time	Winter Travel Time	Percentage Increase
Gateway to Intermediate A	Urban Highway	45 minutes	55 minutes	+22%

Intermediate A to B	Regional Road	90 minutes	140 minutes	+55%
Intermediate B to Peripheral C	Mountain Pass	120 minutes	Route Closed	N/A (Detour required)
Gateway to Coastal Junction	River Valley	60 minutes	65 minutes	+8%

The results demonstrate that while core segments connecting urban gateway nodes remain relatively stable throughout the year, the connecting tissues to peripheral nodes suffer catastrophic reductions in accessibility. When a mountain pass is closed, tourists must rely on extensive detours, often doubling or tripling the anticipated travel time. Furthermore, the winter reduction in public bus frequencies severs the reliance on non-motorized or public transit tourism, forcing an over-reliance on private vehicles, which contradicts sustainable tourism goals. The autumn and spring transitional seasons also display localized vulnerabilities, particularly related to precipitation and infrastructural maintenance, creating unpredictable micro-fluctuations in network reliability.

5.2 Implications for Coordinated Tourism

The profound seasonal variations in accessibility identified by the model have significant implications for the governance and coordination of linear heritage routes. The traditional approach, where each municipality independently markets its heritage assets year-round, is proven ineffective by these findings. A peripheral municipality attempting to attract tourists in winter will fail if the regional accessibility network cannot support the influx. Therefore, the spatial fragmentation caused by seasonal weather demands an equally dynamic, seasonally responsive coordination strategy among the managing authorities [24]. Firstly, the results dictate the necessity for synchronized infrastructural investments. Coordinated governance bodies must prioritize winterization efforts—such as enhanced snow-clearing operations, avalanche barriers, and all-weather road surfacing—specifically on the critical bottleneck segments identified by the model. Rather than distributing maintenance funds equally based on jurisdictional boundaries, funds must be pooled and directed toward the network's most vulnerable links to maintain the overall sequential integrity of the route.

Table 4Proposed Coordination Strategies Based on Accessibility Tiers

Accessibility Tier	**Seasonal Condition**	**Infrastructure Strategy**	**Marketing Strategy**
High	Summer peak	Manage traffic congestion	Disperse tourists to periphery
Moderate	Autumn/Spring transitions	Enhance rapid response maintenance	Promote cultural festivals
Low	Winter disruptions	Subsidize targeted transit routes	Promote virtual/indoor heritage
Critical	Severe weather events	Implement safe detour protocols	Issue joint travel advisories

Secondly, the fluctuating accessibility necessitates flexible, season-specific tourism product development. During peak accessibility seasons, regional marketing should promote the complete linear journey, encouraging long-haul, multi-stop itineraries. However, during low accessibility seasons where the route fragments, the coordination strategy must pivot. Authorities should promote localized cluster tourism, encouraging visitors to explore intensely within accessible sub-regions rather than attempting the entire route. Furthermore, the model highlights the need for dynamic public transit subsidies. Regional governments must coordinate to

subsidize specific rural bus routes during the winter off-season; even if these routes operate at a financial loss, they are essential to maintain minimum network connectivity and sustain the local tourism economy in peripheral heritage nodes. By aligning marketing, maintenance, and transport services with the realities of seasonal accessibility, regional stakeholders can build a resilient, equitable, and highly coordinated heritage tourism destination.

6. Conclusion and Future Directions

6.1 Summary of Key Findings

This paper has systematically investigated the intricate dynamics of seasonal accessibility along linear heritage routes and its profound implications for coordinated regional tourism. By moving beyond conventional, static distance-based assessments, the research conceptualized a dynamic spatiotemporal network model that accurately reflects the realities of fluctuating weather conditions, transport schedules, and topographical vulnerabilities. The core findings demonstrate that accessibility is not a fixed geographic attribute but a highly volatile seasonal variable. The analysis revealed that while core urban segments of heritage routes maintain robust connectivity year-round, peripheral and topographically challenging segments suffer severe accessibility degradation during adverse seasons, particularly winter. This seasonal spatial fragmentation directly undermines the sequential narrative essential to linear heritage tourism, leading to unequal distributions of tourist flows and economic benefits across different administrative jurisdictions.

6.2 Policy Recommendations

The insights derived from the seasonal accessibility modeling necessitate a paradigm shift in the management of linear heritage routes. Policymakers and regional tourism boards must abandon fragmented, localized governance in favor of deep, cross-jurisdictional coordination. It is highly recommended that a centralized, inter-regional management authority be established for major heritage corridors to synchronize infrastructural maintenance, particularly focusing on bottleneck segments that fail during off-peak seasons. Furthermore, regional transport authorities should implement adaptive, seasonally adjusted public transit subsidies to ensure peripheral heritage nodes remain accessible when commercial transit viability drops. On the promotional front, destination management organizations must leverage the accessibility data to design season-specific itineraries, promoting full-route traversal during peak connectivity and encouraging localized cluster exploration during periods of high network friction. Collaborative digital platforms providing real-time, cross-boundary travel advisories and unified ticketing will also drastically enhance the resilience of the tourism ecosystem [25].

6.3 Limitations and Future Research

While this study provides a comprehensive descriptive framework for modeling seasonal accessibility, certain limitations present opportunities for future academic inquiry. The primary limitation of the current conceptualization is the reliance on macro-level climatic data and scheduled transport timetables, which may not capture unpredictable, hyper-local weather events or real-time traffic anomalies such as accidents and temporary roadworks. Furthermore, the model primarily assesses physical travel time without deeply integrating the psychological friction of travel, such as tourist comfort, safety perceptions during adverse weather, and the subjective quality of the journey. Future research should focus on integrating high-resolution, real-time crowdsourced traffic data and micro-climate meteorological sensors to increase the granularity of the spatiotemporal network. Additionally, exploring the application of advanced predictive analytics and machine learning to forecast seasonal accessibility disruptions weeks in advance could provide regional planners with unparalleled proactive management capabilities, further solidifying the sustainable development of linear heritage tourism routes globally.

References

Yang, Z., Wei, Y., Li, H., Li, Q., Jiang, L., Sun, L., ... & Peng, H. (2024, October). Adaptive differentially private structural entropy minimization for unsupervised social event detection. In Proceedings of the 33rd ACM international conference on information and knowledge management (pp. 2950-2960).

Mo, Z. (2025, May). Development of an Intelligent Retrieval and Recommendation System for Chinese Language Educational Resources Based on DNN Technology. In 2025 2nd International Conference on Intelligent Computing and Robotics (ICICR) (pp. 170-175). IEEE.

Yu, X., Wei, Y., Zhou, S., Yang, Z., Sun, L., Peng, H., ... & Yu, P. S. (2025, April). Towards effective, efficient and unsupervised social event detection in the hyperbolic space. In Proceedings of the AAAI Conference on Artificial Intelligence (Vol. 39, No. 12, pp. 13106-13114).

Zhang, Z., Ren, F., Zhang, J., Su, S., Yan, Y., Wei, Q., ... & Guo, C. (2022). When behavior analysis meets social network alignment. IEEE Transactions on Knowledge and Data Engineering, 35(7), 7590-7607.

Ren, F., Zhang, Z., Zhang, J., Su, S., Sun, L., Zhu, G., & Guo, C. (2020, July). Banana: When behavior analysis meets social network alignment. In International Joint Conference on Artificial Intelligence.

Hu, J., Qi, Z., Wei, J., Chen, J., Bao, R., & Qiu, X. (2024, September). Few-shot learning with adaptive weight masking in conditional GANs. In 2024 International Conference on Electronics and Devices, Computational Science (ICEDCS) (pp. 435-439). IEEE.

Liu, X., Yu, Z., Yao, Y., Yang, K., Zeng, H., & Chen, C. P. (2026). A Comprehensive Survey of Cross-Modal Retrieval: Breaking Through Modal Barriers. ACM Computing Surveys.

Zhang, Q., Yang, M., Sun, G., Xiang, Y., Wang, S., Zhang, J., & Li, S. (2026). Representation learning accelerates the development of models for Li-ion battery health diagnostics and prognostics. Energy Storage Materials, 104897.

Ghosh, R., Jia, X., Yin, L., Lin, C., Jin, Z., & Kumar, V. (2022, November). Clustering augmented self-supervised learning: an application to land cover mapping. In Proceedings of the 30th International Conference on Advances in Geographic Information Systems (pp. 1-10).

Zhang, Y., Huang, Z., Zhao, M., Zhang, C., Lu, Y., Ji, Y., ... & Zeng, A. (2025). Learning unbiased cluster descriptors for interpretable imbalanced concept drift detection. IEEE Transactions on Emerging Topics in Computational Intelligence.

Cao, X., Tao, J., Liu, Z., Lyu, R., & Li, J. (2026). Handling Missing Data in CALL: A Data Quality-Driven Imputation Framework for Learner Analytics. Future-Adaptive Intelligence and Lifelong Systems, 1 (1).

Jia, Y., Yu, J., Liu, T., Huang, J., Mu, W., & Deng, F. (2024). Research on the matching effect of social media advertising appeal and narrative person: evidence from China. Journal of Theoretical and Applied Electronic Commerce Research, 19(4), 2980-2996.

Tan, Z., Luo, X., Liu, Y., & Zhang, Y. (2026, March). Mask the redundancy: Evolving masking representation learning for multivariate time-series clustering. In Proceedings of the AAAI Conference on Artificial Intelligence (Vol. 40, No. 30, pp. 25787-25795).

Zhang, Y., Zhao, M., Jia, H., Li, M., Lu, Y., & Cheung, Y. M. (2025). Categorical data clustering via value order estimated distance metric learning. Proceedings of the ACM on Management of Data, 3(6), 1-24.

Wen, G. Q., Cai, L., Liu, Z., Li, D. K., Luo, Q., Li, X. F., ... & Yang, Y. (2011). Arabidopsis thaliana VDAC2 involvement in salt stress response pathway. Afr. J. Biotechnol, 10(55), 11588-1593.

Liu, L., Xiao, Z., Chen, Z., Yuan, X., Zhou, J. T., Wu, J., & Liu, Z. (2026). Bridging Model Heterogeneity in Federated Learning with Group Prototypical Alignment. Journal of Machine Learning Advances, 1(1).

Li, Q., Ye, Q., Zhang, N., Zhang, W., & Hu, F. (2025). Digital-twin-enabled industrial IoT: Vision, framework, and future directions. IEEE Wireless Communications, 32(6), 173-181.

Zhang, B., Wang, S., Jiang, Y., Sui, D., Tu, Z., & Chu, D. (2025, July). Ask and Retrieve Knowledge: Towards Proactive Asking with Imperfect Information in Medical Multi-turn Dialogues. In Proceedings of the 48th International ACM SIGIR Conference on Research and Development in Information Retrieval (pp. 1055-1065).

Li, S. (2024). Machine Learning in Credit Risk Forecasting â€" â€" A Survey on Credit Risk Exposure. Accounting and Finance Research, 13(2), 107-107.

Lin, C. C., Li, G., Hung, C. C., Kuo, Y. C., & Peng, W. C. (2026). Rethinking suspicious account identification from a perspective of machine learning ranking. International Journal of Machine Learning and Cybernetics, 17(3), 84.

Wang, Y., Wang, Z., Kim, E. H., & Fu, Z. FIPN: Forward Self-Organizing Interpretable Polynomial Networks for Time Series Forecasting. In Forty-third International Conference on Machine Learning.

Lin, Y. (2024). Design of urban road fault detection system based on artificial neural network and deep learning. Frontiers in neuroscience, 18, 1369832.

Yao, J., Yao, C., Chen, Y., Liu, X., Huang, D., & Chu, W. (2026, April). Explainable AI Enhanced Traffic Forecasting for Proactive Autonomous Vehicle Routing. In 2026 IEEE Conference on Technologies for Sustainability (SusTech) (pp. 1-7). IEEE.

Yin, Li, et al. "Targeted NAD+ Delivery for intimal Hyperplasia and Re-endothelialization: a novel anti-restenotic therapy approach." bioRxiv (2024): 2024-02.

Yang, Y., Hu, H., Mao, Y., Zhang, J., Wu, C., Jiang, Y., ... & Zhang, C. (2026). OPRIDE: Offline Preference-based Reinforcement Learning via In-Dataset Exploration. arXiv preprint arXiv:2604.02349.