

## Urban Semiotics of the Historic Kaleiçi City: Revealing the Impact of Urbanization through the Argo Ship Metaphor

Nurdan Akiner<sup>1</sup>, Muhammed Ernur Akiner<sup>2\*</sup>, İlknur Akiner<sup>3</sup>, Serkan Kılıç<sup>4</sup>

<sup>1</sup>Akdeniz University, Faculty of Communication, Department of Radio-TV and Film, 07058 Antalya, Turkey

<sup>2</sup>Akdeniz University, Vocational School of Technical Sciences, Department of Environmental Protection Technologies, 07058 Antalya, Turkey

<sup>3,4</sup>Akdeniz University, Faculty of Architecture, Department of Architecture, 07058 Antalya, Turkey  
*ernurakiner@gmail.com*

### Abstract

Urbanization, a prehistoric concept, has evolved to encompass various dynamics influenced by technology, population growth, and lifestyle, significantly affecting a community's cultural heritage. The study uses satellite imagery from Google Earth Pro to assess the impact of urbanization on Kaleiçi, Antalya's historic district, revealing an increase in new constructions and loss of green space since 2004. The study used Matlab-based temporal comparison of satellite imagery to analyze the effects of urbanization in Kaleiçi over 20 years. Roland Barthes, a cultural theorist, encouraged architects and planners to combine semiology with urban theory. Barthes' semiotic theory was applied to the study of Antalya's old city, Kaleiçi, indicating that efforts have been made to conserve Kaleiçi, a city of historical and cultural value, despite changes in its meaning, much as Barthes' metaphor of the Argo ship. Over the last two decades, Kaleiçi has seen a slight (5.6280%) increase in new structures, reflecting the authorities' effective balance between expansion and preservation of the area's distinctive semiotic character. This study contributes to the growing body of knowledge concerning the consequences of urbanization on cultural assets and provides valuable insights for future conservation programs.

**Keywords:** *Roland Barthes; Satellite imagery; Urbanization; Urban Semiotics; Kaleiçi*

### Abstrak

Urbanisasi, sebuah konsep yang telah ada sejak era prasejarah, kini telah berkembang mencakup berbagai dinamika yang dipengaruhi oleh teknologi, pertumbuhan populasi, dan gaya hidup, yang secara signifikan memengaruhi warisan budaya suatu komunitas. Penelitian ini menggunakan citra satelit dari Google Earth Pro untuk menilai dampak urbanisasi pada Kaleiçi, distrik bersejarah di Antalya, yang mengungkapkan peningkatan pembangunan baru dan hilangnya ruang hijau sejak tahun 2004. Studi ini memanfaatkan perbandingan temporal berbasis Matlab dari citra satelit untuk menganalisis efek urbanisasi di Kaleiçi selama 20 tahun. Roland Barthes, seorang teoritikus budaya, mendorong para arsitek dan perencana untuk menggabungkan semiologi dengan teori perkotaan. Teori semiotika Barthes diterapkan dalam studi tentang kota tua Antalya, Kaleiçi, yang mengindikasikan bahwa upaya telah dilakukan untuk melestarikan Kaleiçi, sebuah kota dengan nilai sejarah dan budaya, meskipun terjadi perubahan dalam maknanya, serupa dengan metafora kapal Argo dari Barthes. Selama dua dekade terakhir, Kaleiçi mengalami sedikit peningkatan (5,6280%) dalam struktur baru, yang mencerminkan keseimbangan efektif yang dilakukan otoritas antara ekspansi dan pelestarian karakter semiologi khas kawasan tersebut. Penelitian ini berkontribusi pada pertumbuhan pengetahuan mengenai konsekuensi urbanisasi terhadap aset budaya dan memberikan wawasan berharga untuk program konservasi di masa depan.

**Kata Kunci:** *Roland Barthes; Citra Satelit; Urbanisasi; Semiotika Perkotaan; Kaleiçi*

\*Corresponding Author: Muhammed Ernur Akiner (*ernurakiner@gmail.com*). Akdeniz University, Vocational School of Technical Sciences, Department of Environmental Protection Technologies, 07058 Antalya, Turkey.

### Citation Suggestion:

Akiner, N., Akiner, M. E., Akiner, I., & Kılıç, S. (2026). Urban Semiotics of the Historic Kaleiçi City: Revealing the Impact of Urbanization through the Argo Ship Metaphor. *Journal of Urban Sociology*, 9(1), 1-26. DOI: <https://doi.org/10.30742/jus.v9i1.5257>

## Introduction

The urban environment serves as a medium that accumulates cultural codes transmitted through the intercultural communication process (Chang, 2021; Solomon, 1988). In particular, the

old city space is a point of concentration and synthesis of intersecting historical-cultural and semiotic coordinates. The name "Kaleiçi" means "inside the castle" in Turkish, and the ancient city walls surround the town. The geographical location of Kaleiçi's so-called Old Town is shown in Figure 1.

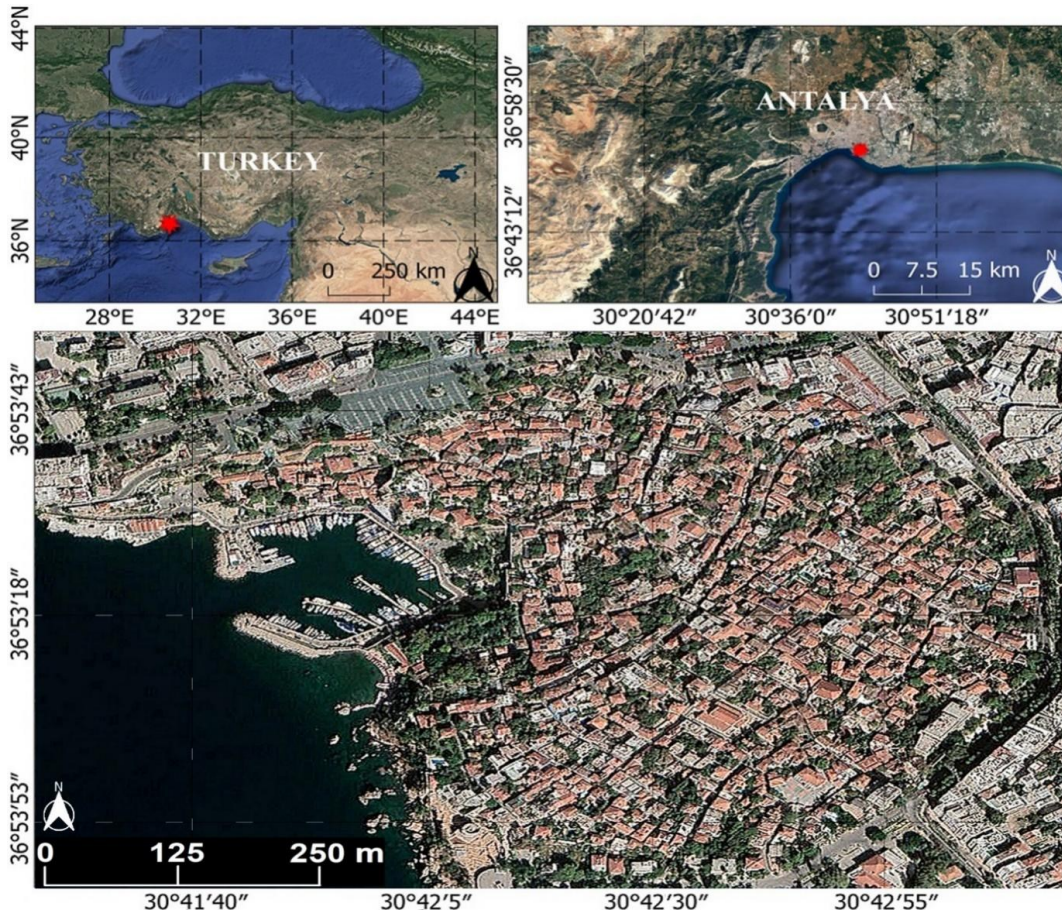


Figure 1. The geographical location of Kaleiçi, Antalya's historic settlement, is depicted in the satellite image.

Kaleiçi is a historic port city founded by Attalos in the 2nd century BC (Dayar, 2023). The narrow, winding streets of Kaleiçi, which was designated a "protected area" in 1973 (Mansuroğlu et al., 2021), the historical buildings, the colorful houses with remnants of Ottoman, Greek, and Seljuk architecture, the streets that open to the sea adorned with bougainvilleas, and the views of the city and harbor between the walls transport visitors back in time. The European Architectural Heritage Year (EAHY 1975) led to the first renovation efforts in Kaleiçi. The Antalya Citadel and Marina Project was implemented by the Ministry of Culture and Tourism in 1975 to conserve a site in a historic city center (Özgönül, 2015).

Placed on the UNESCO World Heritage Tentative List, the Yivli Minaret is the city's earliest Turkish-Islamic structure and stands at the castle gate of Kaleiçi, which encircles the harbor (Akiner & Akiner, 2014; Aygün & Düzgün, 2021).

In addition, Kaleiçi is home to the Antalya Mevlevi Lodge, one of the four earliest Mevlevi lodges in Anatolia. Mevlevi Lodge, a 768-year-old historical landmark constructed by Alaaddin Keykubat, is open for museum visits. Şehzade Korkut Mosque (also known as the Cut Minaret) is a former Byzantine church converted into a mosque (Kökmen Seyirci & Alpaslan, 2022).

Hadrian's Gate (AD 130) and Hıdırlık Tower (2nd century) are prominent Roman-era structures (Soydan, 2020; Yılmaz, 2002).

The Hellenistic era laid the city's foundations, and the arrival of the Turks led to the reconstruction of its fortifications and the construction of significant architectural works (Millán-Gómez & Birgonul, 2018). UNESCO recognizes Kaleiçi and its environs for their ecological and cultural significance (Egresi et al., 2012; Gülduran & Saltık, 2020).

In Figure 2, the Yivli Minaret Mosque, built during the Seljuks Empire; the Historical Harbour and Castle from the Hellenistic Era; the

Hadrian Gate, constructed in honor of Roman Emperor Hadrian's visit; the Hıdırlık Tower, built during Hadrian Era; Şehzade Korkut (Cut Minaret) Mosque built in Seljuks Empire Era (before and after renovation); Historical Mansions from the Ottoman Empire Era; Narrow Streets; and Roman Ruins are depicted from upper left to lower right.



Figure 2. Visions from the Kaleiçi. Photo by Serkan Kılıç.

According to Gottdiener and Lagopoulos (1986), urban semiotics concerns the tangible elements of the built environment, including buildings, squares, streets, parks, and unbuilt cultural goods such as building regulations. Urban semiotics covers minor appliances and

features in urban spaces, particularly architectural elements (Kozlovsky, 2019; Lagopoulos, 2018). Hence, urban research is deepened by interdisciplinary studies. Comparing a historical satellite image of Kaleiçi with today's image using the code in Matlab

provides a foundation for the semiotic investigation. Over time, the negligible change (5.6280 %) in land use and buildings, and the preservation of unique architecture, have enabled the semiotic examination of Kaleiçi.

## Method

A semiotic study can help identify the historical legacy by investigating the signs and symbols associated with a specific historical location, item, or event. This method focuses on analyzing signals and their meanings, enabling us to understand how they shape historical narratives and preserve cultural heritage (Kalaga, 2010). One part of a semiotics study is evaluating physical evidence at historical and cultural sites (Atta, 2021). These indications may include architectural elements, such as certain styles or motifs typical of a given era (Levin, 2016; Savoye, 2011; Yussupova et al., 2017).

The study of signs, symbols, and meanings in urban settings is known as urban semiotics (El-Amrousi and Biln, 2013). The ancient quarter of Antalya is home to several impressive architectural examples, including medieval fortresses, Roman remains, and Ottoman-era buildings. These iconic features serve as vital indicators of their cultural and historical relevance. Architecture reflects a society's cultural identity. Buildings' design, style, and materials frequently reflect local customs or ideals (Nasir and Kamal, 2021).

### *Matlab-based temporal comparison of satellite images to analyze urbanization*

The most significant influence of urbanization is cultural change, driven by greater cultural diversity as individuals from many origins and areas come to cities for better opportunities (Mounin et al., 1980; Robinson and Roy, 2015; Wyly, 2022).

Urban identity and landscape transformation are inseparably connected. As cities expand and evolve, the physical environment and architecture frequently experience substantial changes (Al-Hadidi et al., 2017; Giuffrida et al., 2018; Vimal et al., 2012). These changes can influence how people perceive and express their urban identities (Todd, 2022).

It is possible to compare trends in land use over time using satellite imagery (Altamirano and Selin, 2016; Bokhari et al., 2022; Zhang et al., 2022). The results of this investigation show that historically significant places are being encroached upon, green spaces are disappearing, and urban areas are growing. These land-use shifts offer substantial visual proof of the changes brought about by urbanization (Bern, 2023; Seress et al., 2014). One technique to determine if Kaleiçi has undergone such a transition is to use historical and current satellite imagery to assess the influence of urbanization. First, the analysis performed on the MATLAB platform compared satellite images from 2004 to 2024. A thorough method may be developed to assess temporal land-use changes using a Matlab-based temporal comparison of satellite images, emphasizing RGB (Red, Green, Blue) green-channel analysis. By using image fusion techniques to generate maps of land cover change, Wang et al. (2017) demonstrated the utility of satellite imagery for this kind of research. In his discussion of using RGB imaging for remote sensing of plant characteristics, Kior (2024) emphasized the importance of color analysis in understanding changes in the surrounding environment. Kim et al. (2022) developed an RGB image analysis tool to measure plant health using leaf green reflectance, demonstrating the potential of RGB color models for assessing vegetation conditions.

### *Semiotics*

Semiotics is concerned with signs and their meanings (Cooper, 2023). It originated with linguist Ferdinand de Saussure's 1915 book *Lessons in General Linguistics* on the possibilities of semiotic analysis. It is now employed in film, theater, architecture, medicine, and other disciplines (Chandler, 1994; Goharipour et al., 2021; Suboticki et al., 2021). Thus, this strategy, which spread globally in the early 20th Century, influenced semioticians such as Roland Barthes and Umberto Eco, whose ideas serve as the foundation for our work. According to Saussure, language, central to his work, is a system of signs that involves a sophisticated process of meaning based on opposition (Smith and Riley, 2008). Saussure (Chandler, 1994), who believed that the link between signifier and signified was arbitrary and

conventional, set the path for semiotics by arguing that it was possible to investigate the meanings of language and non-linguistic signs. Like Claude Levi-Strauss, Roland Barthes advocated for a semiotic understanding of culture by focusing on it and drawing on Saussure. This approach links linguistics and culture, allowing cultural aspects to be read as text and interpreted in numerous ways.

Many actors contribute to the city's physical, social, economic, cultural, and political development. Aside from professional organizations (architects, investors, entrepreneurs, local politicians, municipal government members, and artists), citizens' varied forms of collective action help shape the physical and social appearance of urban environments (Giersig, 2008; Paül et al., 2022). The built environment of cities reflects the views of previous and current generations toward urban planning. However, they also represent the increasingly diversified and frequently contradictory interests of numerous and unequally powerful social groupings. As a result, cities are influenced by complex interactions among local factors and developments, as well as by retrospective influences at the regional, national, and global levels. In this perspective, the reality of cities can be seen as a multilayered and multidimensional "urban palimpsest" (Pauwels, 2009). Each city's distinct identity stems from the intricate structure of layers and dimensions (Hassenpflug, Giersig, and Stratmann, 2011). Geoffrey Broadbent (1980) and Umberto Eco (1986) make significant empirical contributions to the study of architecture's semiotics, establishing the role of urban artifacts and the social, economic, and cultural domains that produce them in urban design.

### ***Urban semiotics***

According to semiotics, "the old city space" is now that area of urban space that has developed into a "collective work of art," the outcome of several generations' symbiosis and intersection, layering and denoting historical-cultural coordinates (Yanushkevich, 2014). Furthermore, the core city area, today known as "the old city space," was a translatable population lifeway projection throughout many historical eras, according to the analytically defined

patterns of the semiotic urban environment. According to the communicative model of the urban environment, the concept of "the old city space" is associated with a historical "portal," a medium that speaks directly to its semiotic paradigm. Since their inception, historical cities have evolved in response to environmental and social factors (Raaphorst, 2018). These changes are also evident in the physical constructions of cities (Seçilmişler et al., 2015). Seçilmişler et al. (2015) offer a semiotic perspective that considers shifts in meaning and connotation, highlighting that the leisure places Istanbul society inherited from the Ottoman Empire have altered.

Barthes (1986), one of the pioneers of semiotics, applies his theoretical framework to the analysis of cities, selves, and cultures. He focuses on how signs and symbols in the urban environment contribute to personal and cultural identity. To better understand how urban signs contribute to a city's overall meaning and identity, Krampen (2013) researched these components of semiotics. Policy implications related to urban semiotics are also discussed in the study.

Yanow's (2015) work delves into how cities can be read and interpreted through an oppositional lens, focusing on the conflicts and differences within urban spaces. He also discusses the idea of a more communicative semiotics that seeks to create dialogue and understanding between different urban elements. Stojiljković and Ristić Trajković's (2018) research comprehensively explores urban semiotics, treating the city as a cultural and historical phenomenon. It covers a range of topics, from the symbolism of architecture and urban design to the semiotic analysis of urban legends and myths. Lagopoulos (2019) discusses how urban spaces can be read as texts, with their unique symbols, signs, and codes. It explores the components of urban semiotics, including architecture, street names, and public spaces. Nas's work (2011) is a semiotic study of the discourse surrounding cities, exploring how language and imagery shape our understanding and experience of urban spaces. It also discusses how the city is often represented as an invisible entity, constructed through signs and symbols rather than tangible elements. In this context, Kaleiçi was analyzed through urban semiotics,

drawing on the ideas of intellectuals such as Barthes, Eco, and Lynch.

Eco (1986) investigated architectural components in terms of their meaning and functionality. It has also produced a corpus of work that enables architects, urban designers, and others to modify the environment and influence how people perceive it. According to Gottdiener and Lagopoulos (1986), streets, squares, buildings, and façades are semiotically significant features of urban space. One of the most essential semiotic sources is Kevin Lynch's *City Image*, released in 1960. Lynch (1984) defined physical urban form using a reductionist method, and the intelligibility of spatial features like roadways, nodes, and edges marked a watershed moment in architectural research. In his *Semiotics and Urbanism* piece, Roland Barthes (1988) challenged everyone to engage in amateur city readings, expanding the parameters of semiotics and claiming that cities could be read like texts. Barthes' work was hardly the first attempt to examine a metropolis. Kevin Lynch (1960) developed the concept of "imageability" in his book *Urban Image: Imaginability*. Imaginability refers to the ability of a physical item to evoke a strong image in the mind of any observer. Form, color, or layout can vividly define the image of the environment, making it well-structured and incredibly useful. Legibility or visibility refers to the sharpness and intensity with which the senses of sight and others perceive objects.

Lynch (1960) also proposed a method for urban analysts in his study. Lynch, who classifies cities into units, believes visuals should be interpreted on three levels. Identity, structure, and meaning are the three components. Identity distinguishes the item from other objects; the structure is the object's relationship to the observer and other objects, i.e., the object's emotional influence on the observer.

Barthes, who chastised Lynch for being a Gestaltist, reinterpreted his approach from a structuralist standpoint. According to Barthes (1988), who defines his method as "dividing the city text into units, then distributing these units into formal classes, and in the third stage, finding the rules of combination and transformation of these units and models," there is a conflict between the functionality and semantic power of a portion of the city. For example, if we look at a

map and believe in reality and objectivity, we can declare that two neighborhoods are adjacent, but they are divided because they have two meanings.

### *A Barthesian analysis*

Fiske and Hartley (1978) proposed that semiotics could be defined as the science of signs, particularly as it relates to human culture. The discipline was advanced to the level of reputable research by the well-known French cultural analyst and semiotician Roland Barthes, who followed Ferdinand de Saussure, a linguistic structuralist, and examined cultural phenomena as language systems. However, he went further than Saussure in applying structuralism to commonplace, non-linguistic things like literature, ads, fashion, photography, films, music, and even concepts of history, the self, urban, and nature.

According to Roland Barthes' theoretical approach, there are three levels of signification: denotation, connotation, and ideology. While explaining how denotations become connotations saturated with meaning, Barthes points to mythology, or what is commonly called "ideology" – the third order of signification. The role of urban signs in shaping a city's overall meaning and identity is significant. This is evident in the connotative signs found across various contexts, from the semiotic analysis of urban legends and myths to the symbolism of architecture and urban design. Barthes (1988) emphasizes that signifiers remain constant, while what is signified changes over time and context. He defines city centers as places of exchange for social and, in the broad sense, erotic activities, as they are semantically places of encounter with others, and adds that the semantic description of the city should not be limited to a unit. According to Barthes, each city was built using the ship *Argo*, a figure from Greek mythology, on which Jason and the Argonauts sailed from Iolkos to capture the Golden Fleece. Although no parts of the ship are original, the ship has always been known as the *Argo*. In other words, meanings are easy to read and determine (Evslin, 2023). When Barthes' theoretical approach to urban semiotics is used, *Kaleiçi* is likewise the ship *Argo*. None of its pieces are the natural first piece, but *Kaleiçi* has always been the Natural First Piece. Barthes'

Three Levels of Signification adapted to the Historical Kaleiçi City is shown in Figure 3. The three signification orders established by Barthes, which include denotation, connotation, and ideological signification, will be employed to

analyze every principal urban element in Kaleiçi because this method provides consistent analytical results.

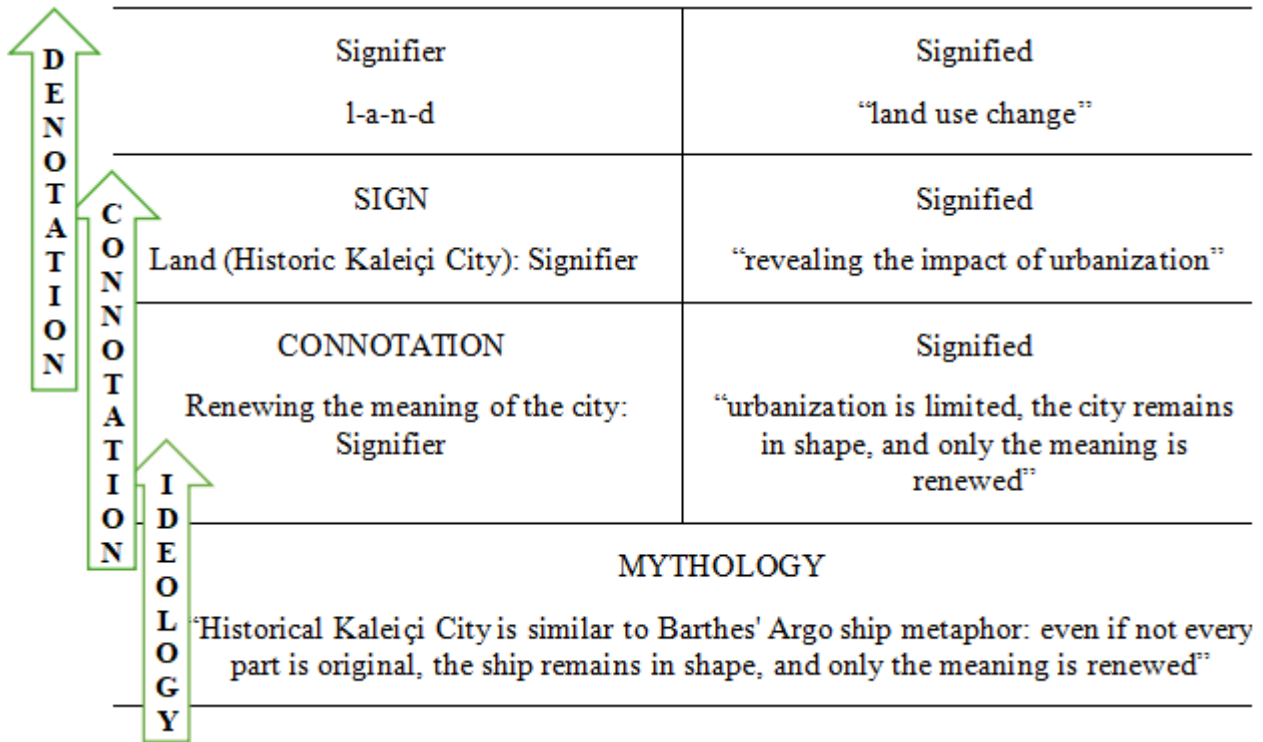


Figure 3. Barthes' Three Levels of Signification: 1. Denotation, 2. Connotation, 3. Ideology.

Umberto Eco took a similar approach, incorporating architectural aspects into semiotic analysis. According to Eco, each object in an architectural structure can serve denotative and connotative functions. To the point that an item must be built in such a way that its purpose is evident and valuable. However, we can discuss the connotations of items when their communicative meaning outweighs their functions (Eco, 1986).

**Mixed-Methods Framework: Integrating Quantitative Remote Sensing and Qualitative Semiotic Analysis**

This study employs a complementary mixed-methods design (Jiang, 2003; Yu, 2025), which combines quantitative remote sensing analysis with qualitative semiotic interpretation to examine how urbanization affects Kaleiçi's cultural heritage. The integration of two research methods employs a sequential explanatory approach, requiring researchers first to assess

land-use changes using quantitative methods before conducting their semiotic analysis of urban meaning-making.

The study uses its sequential explanatory framework to conduct quantitative research to assess how physical changes in the built environment unfold over time. The study's measurements document changes in the built environment, yet they also establish legal limits that guide future semiotic analysis. The construction rate, as shown by its hypothetical high level, indicates that historical signifiers will completely disappear due to major morphological changes. In contrast, the construction rate, at its current low level, indicates that material elements of the site will persist, enabling analysts to study Barthes' Argo ship metaphor by showing how the meanings of existence (connotations) change without altering the main elements. The physical evidence of change that researchers observe through semiotic analysis shows that these changes occur through the three signification systems that Barthes

established: denotation, connotation, and the ideological interpretation of satellite data.

The mixed-methods approach provides both measurement and meaning through its system, as the first element yields temporal reliability and spatial scope. In contrast, the second delivers cultural understanding and explanatory strength. The study maintains methodological transparency through three different procedures which involve spatial correspondence to define geographical boundaries of satellite image analysis that match the area of semiotic walk-throughs and architectural inventory and temporal alignment to show that image analysis occurred during the 20-year period which included the peak of tourism-led urban development in Antalya, so semiotic analysis can use actual documented functional changes and cross-validation to verify all semiotic assertions regarding functional change through testing against land-use changes shown in change-detection maps, which enables researchers to base qualitative findings on actual spatial transformations.

## Results and Discussion

Today, Kaleiçi is a tourist hotspot, with restaurants, cafés, nightclubs, beaches, and

tourist boats sailing from the port and bazaar. However, when we study its historical context, we can see that Kaleiçi contains the latent meanings Barthes characterizes as myth, in other words, the connotation buried below the literal sense, resulting in a unique meaning-making process.

Globally, one of the main concerns has been the fast urbanization and its effects on historic areas. Turkey's southwest coast is home to Antalya, renowned for its distinctive architecture and extensive historical legacy. However, the impact of urbanization on Antalya's historic district has not been well investigated. To close this information gap, this study will examine the urban semiotics of Antalya's historic area and use temporal satellite map analysis to reveal the effects of urbanization.

### *Matlab-based temporal comparison of satellite images*

The study aims to offer significant insights into the patterns, trends, and consequences of urbanization in Antalya's old town, Kaleiçi, by utilizing sophisticated image-processing techniques. Figure 4 shows the satellite images from 2004 and 2024, respectively. Satellite imagery was collected using Google Earth Pro.



Figure 4. Satellite images from 2004 and 2024 depict Kaleiçi's settlement and urban landscape, both old and current.

MATLAB image processing can be an effective tool for analyzing historical satellite imagery and understanding land-use change. The first step is to import the satellite maps. The

'imread' function reads an image file (Ijamaru et al., 2021). If we wish to display the true-color image in green, we may use the green color band, the second color in the RGB code (Chhaya et al.,

2015; Goel et al., 2017). The "green2004=kaleici2004(:, :, 2)" command allows us to display the picture, which ordinarily has three colors, exclusively in the green color band (Duth and Deepa, 2018). In this approach, we define the property's green space. The "gray2004=im2gray(green2004)" command is then used to change the green tone to gray (Sujan

et al., 2016). The "imshow" function allows us to examine the findings in both green and grayscale. When the green tone is transformed to gray, a subtle alteration occurs that cannot be detected with the naked eye, as seen in Figure 5. Similar processes were conducted on the satellite map 2024 (Figure 6).

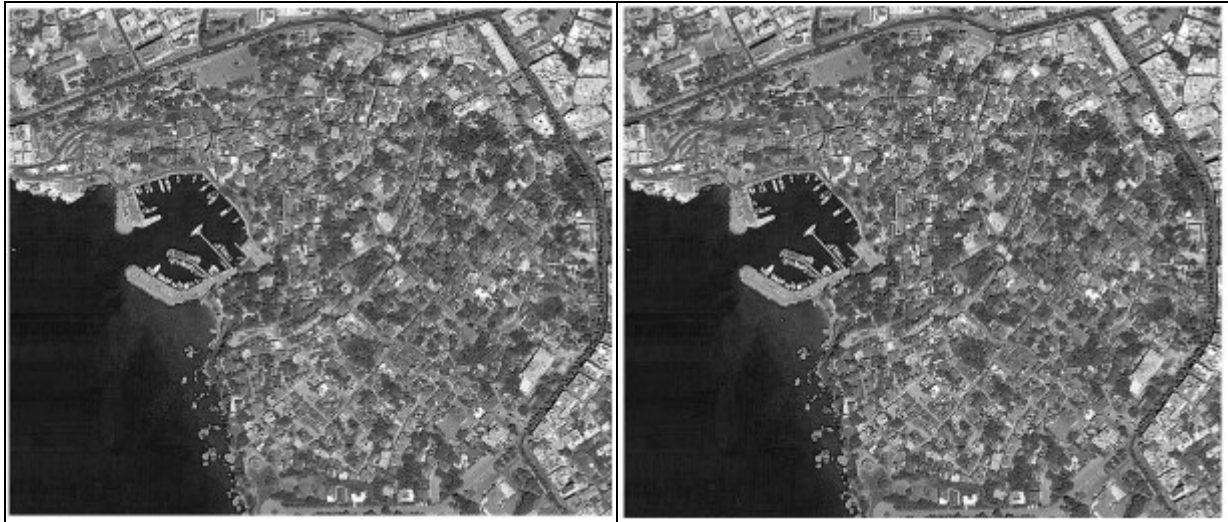


Figure 5. The 2004 Kaleiçi map is depicted in RGB green color coding and grayscale.



Figure 6. The 2024 Kaleiçi map is depicted in RGB green color coding and grayscale.

The goal at this stage is to calculate the grayscale difference between 2024 and 2004. The command "difference=gray2024-gray2004" was used to accomplish this task. Because it is transformed to green and then to gray tones, the "difference" variable displayed with the "imshow" command results in white blotches on the map. These white blotches represent changes in land usage. In other words, white blotches show areas that were green in 2004 but not in 2024 (See Figure 7). The command

"imshowpair(kaleici2004,kaleici2024)" allows us to compare the years 2004 and 2024 (Singh et al., 2020). Figure 7 shows magenta-colored regions where new construction occurred between the two eras. Finally, using the "difference" function to obtain the construction value as a percentage, we can determine the construction in 2024 with the commands "construction2024 = difference >.7" and "construction2004 = difference <.3". Here, 0.7 and 0.3 represent 70% and 30%, respectively.

As a result, we can identify spots near white for 2024 and distant from white areas for 2004. The command "construction\_percent=nnz(construction2024)/numel(construction2024)\*100" calculates the ratio of "nnz" (non-zero (white) pixels) to "numel" (all pixels), which will also offer us a new construction rate. The findings reveal that construction in Kaleiçi has increased by 5.6280%.

This finding implies that Kaleiçi's historical and cultural value has been acknowledged, and efforts have been made to conserve it. The fact that the construction has increased relatively slowly over the last 20 years suggests that the authorities and parties engaged have successfully balanced the need for growth with the need to preserve the area's unique character.

The study's limitation is that the oldest available satellite map is from 2004. This study may also face limitations in resolution and computational capacity.

### ***Validation of the Quantitative Analysis***

Two additional validation steps were conducted to enhance both the threshold validity and the entire change detection process. First, the researchers compared MATLAB results with three independent sources: the municipal conservation plans of Antalya from 2005 to 2020, historical cadastral records, and on-site photographic surveys conducted in 2023 to 2024. The sources established that the areas marked in magenta in Figure 7 primarily correspond to adaptive reuse projects and infill construction, resulting in low change rates, as discussed in the following section. The sensitivity analysis determined threshold values of 0.7 for new construction and 0.3 for unchanged green areas, as these thresholds allow tracking of spectrally stable green pixels. In contrast, 0.7 thresholds identify pixels with extreme spectral differences, resulting in accurate detection of seasonal

vegetation changes and shadow artifacts. The researchers validated the thresholds by comparing automated results with manual digitization of 10 percent of the study area, which revealed an agreement rate of 92.4 percent.

### ***Integrating the Quantitative Finding with Semiotic Analysis***

The comprehensive analysis of construction activities over two decades, which shows that 5.6280% of new construction occurred, requires semiotic research to determine its full value. The three specific insights about physical changes resulting from their low rate of change are: the satellite-based analysis shows that most buildings, street patterns, and green spaces have not changed, which supports Barthes' theory that signifiers maintain their original form. At the same time, signifieds transform testing through scientific research. The Argo ship metaphor requires two elements: traditional ship design elements and new definitions of words. The 5.6280% figure shows material continuity because it represents the ship's design, while the port, baths, and religious buildings give it new meaning. The metaphor maintains its original meaning because the tiny change can lead to two opposite outcomes: total replacement or frozen heritage. The mixed-methods approach shows that Barthes' theory is a valid concept, as it presents evidence from multiple research methods. The evidence shows that conservation work between 1973 and 1975 achieved its goals, as the protected area was established and the Antalya Citadel and Marina Project began. The analysis shows how conservation work achieved its results through the establishment of Kaleiçi as a museum, which altered its original meaning by using walls for both defense and enjoyment, and madrasahs for educational purposes and souvenir sales. The finding creates direct benefits for historic districts that experience increasing urban development pressures.



Figure 7. A change map showing Antalya Kaleiçi's land use changes in white (left), and more precisely depicted on the current satellite map by magenta-colored (right) between 2004 and 2024 (increase in constructions in Kaleiçi is 5.6280 %).

**Systematic Barthesian Analysis of Kaleiçi's Urban Elements**

To operationalize Barthes' semiotic framework through its three organizational structures, we analyze each significant urban component in Kaleiçi at three distinct levels of evaluation. The first level of evaluation requires denotation, which describes fundamental sources in terms of their physical attributes and

functional characteristics. The second level of evaluation requires connotation, which describes all cultural meanings and historical associations that have developed through time. The third level of evaluation requires analysis of fundamental beliefs, including worldviews such as "Kaleiçi as the Argo ship" and "the city as a palimpsest." Table 1 summarizes this systematic reading.

Table 1. Barthes' three orders of signification applied to Kaleiçi's urban elements.

Urban Element	Denotation (literal/physical)	Connotation (historical → contemporary)	Ideology (myth / underlying meaning)
<b>Port</b>	Quay, tourist boats, fishing boats, restaurants	International trade hub (East-West luxury goods) → Tourism and entertainment center	"Argo ship": same vessel, renewed meaning; the city's "eroticism" (Barthes) as sociality.
<b>Baths (Hamams)</b>	Stone buildings with cold/hot sections, domes	Hygiene, health, socialization, therapy → Touristic cultural experience, souvenir shops	Continuity myth: Roman-Turkish bathing culture as timeless heritage
<b>Yivli Minaret Mosque</b>	Fluted minaret, mosque, former Byzantine chapel	Byzantine church → Seljuk mosque → City symbol	Religious palimpsest: different faiths in the same space, yet meaning persists
<b>Hadrian's Gate (Üçkapılar)</b>	Three arched gates, marble columns, and towers	Roman imperial honor, city entrance → Tourist photo spot, gateway to old town	"Majestic entrance" myth: power and wealth displayed across eras
<b>City Walls</b>	Stone fortifications, bastions	Security, defense → Pleasure walk, viewing terrace, entertainment venue	Functional transformation without signifier change: walls now signify "leisure."
<b>Courtyard Houses</b>	Two-story houses, inner courtyard, pebble mosaics	Ottoman privacy, family life → Boutique hotels, cafés, bars	Seclusion signifier re-signified as hospitality and consumption

The systematic application shows that Kaleiçi maintains a repeating pattern because its denotative structures remain almost unchanged, with a 5.6280% rate of physical change measured

from satellite images. At the same time, its connotations transitioned from production, defense, and worship to tourism, leisure, and consumption. The ideological level-the enduring

myth of “Kaleiçi as the eternal Argo” – explains why the district retains its identity despite semantic renewal. The Barthesian framework enables researchers to arrange their qualitative data while using the theoretical framework to explain why material changes are not significant. The subsequent subsections use the established systematic framework to provide a comprehensive semiotic analysis of urban elements and spaces in Kaleiçi, supported by photographic evidence and field study results.

### ***Semiotic analysis of economic and commercial life in Kaleiçi within the context of the Port and Bazaar***

In the 9th Century BC, Greek sailors traveled to Syria and Phoenicia via Rhodes and Cyprus, trading with various communities along the Mediterranean coast (Jankowska, 2019).

Today, the port's purpose has been supplanted by "Hesapçı Street" and restaurants in the surrounding region. Wine, fish, and olive oil are no longer port products in Kaleiçi; they meet tourists along the commercial chain. Many goods are sold ready-to-serve. Today, the port region is less critical than in ancient times. Commercial goods come via land, not by sea. Thus, while the port area in Kaleiçi was the initial stage where products entered the city, it is now the final stage where they are ready for service, thanks to the restaurants established there.

Kaleiçi's historical port hosts both tourist boat cruises and small fishing boats. In a literal sense, it is the hub of tourist activity. Given its historical context, it is clear that the historical port in Kaleiçi served as a link between East and West. Luxury products (spices, textiles, carpets, precious stones, and glass-metal works) from Egypt, Palestine, and Libya in the Mediterranean were delivered to Venetian, Genoese, Italian, and even Spanish merchants in Kaleiçi. As a result, the port has become a hub of international trade

(Cimrin, 1999). The new world order, economic system, and numerous other factors have abolished the possibility of global trade at ports; sailing boats and galleys are now available for inexpensive sea cruises for tourism. With a long history of high commerce volume, the port serves as Kaleiçi's entryway to the outside world. When viewed through urban semiotics, the port, a national area, retains the same characteristics today. However, the reason for this is not the cruises but the tourists who visit. The restaurants and entertainment venues that line the harbor, each with its own character, demonstrate how the markers of bustling economic activity have changed over the years. Kaleiçi is the center of interest for the city's population, which has migrated beyond the city boundaries. Kaleiçi is a venue for socializing among young people and adults, and its connotative dimension evokes Antalya's birth.

In this sense, the port and its environs in Kaleiçi might satisfy Barthes' definition of "the eroticism of the city." According to Barthes (1988), the city center is perceived as a space for the interchange of social and sensual activities. In the context of Kaleiçi, this is the principal harbor, and the streets around it are lined with bars and restaurants (See Figure 8). Barthes employs the term eroticism in its entire definition. It would be wild to correlate a city's sensuality with the area dedicated to such entertainment, because the notion of such a location for entertainment is one of the most potent deceptions about urban functioning. It is not a conceptual idea but a functional one. As a result, Barthes employs the ideas of eroticism and sociality interchangeably, as evidenced by the Kaleiçi example. Kaleiçi's connotative dimension includes the "eroticism of the city," which reflects a high level of socialization that transcends national borders and occurs on an international scale.



Figure 8. Transforming the texture of Kaleiçi. Photo by Nurdan Akiner.

Antalya means "Land of Attalos II." Attalos founded it. The city remained independent for a time after the Kingdom of Pergamon (133 BC) dissolved until falling into the hands of pirates. Commander Servilius Isauricus incorporated it into Roman dominion in the year 77 BC. In 67 BC, Pompey's fleet established a base there. Hadrian's visit to Attaleia in AD 130 spurred the city's growth.

During the Byzantine Period, the great cities of the Pamphylia region declined in importance; however, Attaleia (Antalya) remained significant. Only Attaleia, one of the Pamphylian cities, has survived the Seljuk and Ottoman periods to the present day. Attaleia was previously located in Antalya's Kaleiçi area. Antalya Kaleiçi town, formerly known as Attaleia, was Pamphylia's westernmost city. It was founded in the bay around the plain between Akdağ and Beydağ in the Western Taurus Mountains of the Teke Peninsula. The city is still on 20-30 meter-high rocks surrounding a tiny bay (Beaufort, 2002). Because of their loyalty to the Roman Empire, the people of Antalya were granted unique rights and privileges in 203 AD. Hadrian's Gate, the city's principal entrance, and the walls on each side are thought to have originated in the Roman period. Antalya remained within the Byzantine Empire's borders after the Roman Empire was partitioned in 395 AD. The public and officials have traditionally placed a high value on Kaleiçi's security. The walls were restored numerous times to defend the city against Arab invasions. The fact that the walls were built layer by layer demonstrates how

vital security was to the civilizations in this region.

Hadrian's Gate, also known as Üçkapılar, is a massive triumphal arch built on Antalya's city walls to commemorate Roman Emperor Hadrian's visit in 139 AD. It comprises three arched gates with four marble columns on each façade and two adjacent towers (See Figure 9). Kaleiçi is surrounded by horseshoe-shaped walls on both the interior and outside, most of which have been destroyed. The walls are an essential metaphor in Kaleiçi's journey through urban semiotics. The Hellenistic, Roman, Byzantine, Seljuk, and Ottoman periods all contributed to the construction of the 80 bastions that make up the walls. There are around 3000 dwellings with tile roofs within their walls. The distinctive structures of the houses not only provide insight into Antalya's architectural history but also accurately depict the region's culture, traditions, and customs. Today, the walls are seen as a source of pleasure rather than a security risk. The alteration and transformation in our perception of the walls remind us of Roland Barthes' statement that change and transformation in signals are evolutionary rather than revolutionary. For both local and foreign residents of Kaleiçi, the city walls are now a source of entertainment and interaction rather than a security concern. The number of neighborhoods in Kaleiçi decreased during the period. The biggest reasons for these decreases are war conditions, internal rebellions, and natural disasters such as fires (Tızlak, 2002; Dinç, 2016; Dayar, 2020). In 1895, a fire broke out in the Christian neighborhood of Kaleiçi in Antalya, burning down a mosque, a monastery,

and many houses. A notification was sent to the province of Konya to collect aid for the people who had suffered as a result of this fire (Ottoman State Archives: BOA, DH.MKT., Box No: 421,

Queue No: 61). It is thought that Kaleiçi took its present form after the fire.



Figure 9. Hadrian's Gate, also known as Üçkapılar, and its arch detail. Photo by Nurdan Akiner.

When attempting to make sense of the walls, it is vital to consider the other structures around them, as the elements are regarded as signifiers based on their interrelated places rather than content (Barthes, 1988). Visitors to Kaleiçi will first come across the massive triumphal arch on the city walls, erected in commemoration of Hadrian's visit to Antalya and still retaining its splendor to this day. Then, he will go through the city gate and into the streets. The Three Gates, also known as Hadrian's Gate, is one of the most notable emblems of the city's majesty to outsiders, signifying its wealth. The Gate, added during the Seljuk and later periods, connects Kaleiçi to modern Antalya and bears traces of all civilizations.

It is important to remember here that these signs were purposely arranged by the civilizations of the time. While the meaning of the Three Gates, also known as Hadrian's Gate, has not changed, its appearance has. The same Gate leads to Kaleiçi, but now illuminated pavements replace the columned ornamentation. It still indicates that it is more critical than other routes today, albeit in a different manner. Other markers of affluence have spread throughout Kaleiçi and taken on new forms. Jewelers and souvenir businesses are among the latest indicators of prosperity. In addition to functional features, this area's hotels, restaurants, bars, and

cafés have become indicators of prosperity for their customers, thanks to their wall decorations, nostalgic building architecture, historical references, and illuminated signs. While theater activities once served as the foundation of socialization, they have since been replaced by consumption-based venues such as restaurants. Although the commerce agora and theater were designed centuries ago, they are distinct structures. They are close to each other but separated by a wall, so their functions do not conflict. Today, socializing and business areas appear to be distributed throughout the central roadways. The hub of trade and the center of socialization are linked. As with Kaleiçi, it is impossible to say where one begins and finishes.

According to Barthes (1988), who defines his method as "dividing the city text into units, then distributing these units into formal classes, and in the third stage, finding the rules of combination and transformation of these units and models," there is a conflict between the functionality and semantic power of a section of the city. For example, if we look at the map, that is, if we believe in reality and objectivity, we can declare that two neighborhoods are adjacent; nonetheless, these two areas are divided from one another because they have two different meanings. The neighborhoods belonging to Greeks, Muslims, and Jews left behind by

civilizations in Kaleiçi, as well as the walls separating them, which are now difficult to distinguish, are signs of neighborhoods imbued with various meanings (See Figure 10). Even though the minimal alterations to Kaleiçi's

texture caused by tourism and commercial operations have abolished the walls, civilization's symbols remain the most essential topics.



Figure 10. An example of a non-Muslim house in Kaleiçi with architectural details. Photo by Nurdan Akiner.

In the 11th Century, the Byzantines ruled the city. Antalya remained a strong Byzantine castle city until the late 12th Century. The bond between Antalya and Byzantium was severed in 1204, when the Crusades began, and Venice occupied Istanbul (Constantinople). Antalya was an important city for the Seljuks, and most of the historical buildings in Kaleiçi date back to that period. Throughout history, Antalya has grown in importance as an urban center. This period's structures include the Mevlevi Lodge, the Yivli

Minare Complex, the Madrasah, and the Bath (See Figure 11). Because of the Ottoman buildings' location within the city, the city expanded northward beyond the walls. While the organic design was prevalent in the regions where the Turks lived, the grid pattern persisted along the road from Hadrian's Gate to the Hıdırlık Tower until the 1920s. There was a Christian population in this region.



Figure 11. The Gate of the Madrasah in Kaleiçi and its current use. Photo by Nurdan Akiner.

Furthermore, the city evolved into an organic structure during the Ottoman period. Antalya's city walls, restored during the Seljuk period, lost their practical features, as did those of other Ottoman cities. Walls are no longer a part of the city; they have been dismantled over time (See Figure 12). The courtyard, with stairs and divans near the house's entry, is the most distinctive feature of 19th-century Kaleiçi

residences. Most residence floors are paved with black-and-white geometric or figurative pebble mosaics known as 'Rhodes craftsmanship.' Courtyard houses, previously the most important symbol of seclusion in Turkish family life, have given way to boutique hotels or café bars with loud music, indicating a shift in the signs.



Figure 12. An example of a city wall that has endured for centuries and is still standing today. Photo by Nurdan Akiner.

Some of Kaleiçi's buildings from various times have remained to this day (See Figure 13). Baths are one such building type. Traveler's notes from multiple periods have information about Antalya's baths. Traveler Ibn Batuta did not specify the number of buildings in Antalya that he visited between 1329 and 1334, but he did indicate several baths (Güvenç, 1997).

According to Evliya Çelebi, a 17th-century explorer who visited Antalya in 1671-72, Kaleiçi had eight baths. These include Çukur Hamam, Büyük Hamam, Nazır Bath, Mevlevihane Bath, Pasha Bath, Çavuş Bath (outside the castle), Balbey Bath, and Şeyh Bath (See Figure 14).



Figure 13. An example is Turkish houses with a courtyard, now used as a boutique hotel or café bar.  
Photo by Nurdan Akiner.



Figure 14. Ottoman Period Baths located in Kaleiçi. Photo by Serkan Kılıç.

Baths are crucial in city life in Roman and Turkish cultures; hence, the meaning of the baths in Kaleiçi has remained consistent throughout history. During the Seljuk period, the baths at Kaleiçi improved in quality, and additional ones were constructed. Even before the Seljuk period, the Roman baths in Kaleiçi drew considerable attention from the local population. Five distinct purposes of Roman baths can be identified in their historical context. According to Çoban (2016), cleaning aims to safeguard health, keep bodies clean and durable, teach young people self-discipline and strength, treat ailments, and foster sociability.

When we perform a semiotic reading of the baths, we discover that they symbolize cleanliness. On the other hand, baths can be viewed as amusement and socialization centers within the context of the period. Although sanitation is no longer a priority, the baths continue to serve as a social and entertainment focus for tourists and commercial operations. Visitors from across Turkey and the world gather

at the tourist bath in Kaleiçi to mingle and take part in cultural tourism activities.

### ***Semiotic analysis of religious buildings in Kaleiçi***

Religious buildings in Kaleiçi, like other architectural features, provide information about the civilizations of this ancient region. According to Barthes (1988), cities are also a discourse, hence a language; although cities speak to the people who live in them, people also talk about the city by living it. Religious variations in Kaleiçi, which has hosted numerous civilizations throughout history, have led to disparities in architectural styles. Cultural, economic, social, and religious structures from Hellenistic, Roman, Byzantine, Seljuk, Ottoman, and Republican times coexisted. Over time, spaces and facilities have lost their function. On the remains of the Agios Ioannis Theologos Byzantine Church, the Seljuks built the Yivli Minaret and Mosque. According to Barthes, the eroticism of the city is associated with the "sociality" of urban life. The city brings together people with vastly varied

origins and goals. According to Barthes (1988), "The city is the place of our encounter with the other," and "Therefore, the center is the meeting point of any city. "First of all, the city center was built by young people and adolescents."

The Yivli Minaret, a Byzantine chapel turned into a mosque in the 13th Century, has become Antalya's most iconic landmark. A 90-step stone, brick, and Khorasan mortar stairway rises inside the minaret. It is regarded as one of the first Islamic works of the Seljuk era. Mevlevihane is part of the Yivli Minaret Complex. It was built by Sultan Alaeddin Keykubad in 1255 and was first used as a Mevlevi lodge in the 16th Century. The architectural complex includes the Mevlevi Lodge, the Turkish Bath, and the tombs of Zincirkıran Mehmet Bey and Nigâr Hatun. Nigâr Hatun II, the mother of Bayezid's children, Prince Korkud and Fatma Sultan, lived from 1450 until

1503 (See Figure 15). It is known that Prince Korkud was present when his son was appointed from Manisa to the Antalya Sanjak Principality, and he died in the same year and was buried in Antalya. This tomb, similar to Seljuk tombs in architecture, is thought to have been built in the 16th Century during the Ottoman Period, though this is not confirmed (Kaya, 2022).

Palimpsests are the meanings associated with the structure, the intertwining of the old and the new in spatial construction, the persistence of traces, and the spatial emphasis placed. In this way, cities can be viewed as a multilayered and multidimensional "urban palimpsest" (Pauwels, 2009). Today, the Nigâr Hatun Tomb is a prime illustration of this condition. Today, the tomb is incorporated into the tea garden's landscape, a popular destination for city residents and tourists (See Figure 16).



Figure 15. The architectural complex includes the Mevlevi Lodge, the Turkish Bath, and the tombs of Zincirkıran Mehmet Bey and Nigâr Hatun. Photo by Nurdan Akiner.



Figure 16. Nigar Hatun Tomb is a significant example of an urban palimpsest. Photo by Nurdan Akiner.

Today, the Yivli Minaret Mosque Complex and Madrasa (the Ruined Minaret Madrasa) are home to modest businesses selling tourist souvenirs. Madrasahs are educational institutions that provide higher education in Muslim countries. Today, students and teachers have been replaced by tourist merchants, classrooms have been converted into stores, and schools have lost their original purpose, yet the remnants have not vanished entirely.

As Barthes points out, Kaleiçi (Ancient City of Attaleia) has the characteristic of being

made and rebuilt, like the Argo ship, in the historical process that has persisted to the present day and even constructed and re-approved through its ties with its residents (See Figure 17). According to Roland Barthes, the Argo's planks were altered and refreshed throughout its trip, but its name remained unchanged. According to Barthes, "I love you" operates similarly within a relationship; the words remain the same, but their meaning is "renewed" and alters to some extent with each utterance (Mills, 2022).



Figure 17. Kaleiçi is the metaphor for the Ship Argo. Photo by Nurdan Akiner.

***Theoretical Positioning and Contributions***

The theoretical contribution of this study extends beyond its empirical findings, which documented 5.628% physical transformation in Kaleiçi. The study applies Barthes' three orders

of signification, together with MATLAB-based change detection, to address the demands of urban semiotics research for mixed-methods approaches that connect material changes with meaning creation (Douet, 2025; Hosseini &

Barekat, 2025). Khalil (2026) has demonstrated that linguistic relativity shapes urban perception, which we test by showing that different historical periods produce distinct connotations from identical denotative elements (walls, gates, baths), thus proving that observers from varied cultural and temporal backgrounds interpret the "city text" in different ways.

The systematic study of urban elements through denotation, connotation, and ideological analysis demonstrates a direct connection to Samorè's (2025) study of religious architectural spaces, which function as intercultural semiotic systems that merge spatial dimensions with legal and cultural boundaries. The Yivli Minaret, which served as a Byzantine chapel before becoming a Seljuk mosque, and the Şehzade Korkut Mosque, which was a church before becoming a mosque, showcase the urban narratives that Samorè (2025) describes. Our change-detection maps demonstrate adaptive reuse, as documented findings show baths converted into tourist venues and courtyards transformed into cafés. The study by Amjad et al. (2025), which investigates street texts, shows how they create power dynamics through their functional transformations. This theme connects to Arias Álvarez's (2025) research on urban transformation.

Our framework tracks permanent changes in semiotic systems resulting from policy changes, unlike graffiti or photography-based urban semiotics (Amjad et al., 2025; Irawan et al., 2025; Fachmi, 2025), which focus on ephemeral or artist-driven signs. The validation protocol, which includes municipal plan cross-referencing and an RGB threshold sensitivity analysis, and which achieved 92.4% manual agreement, provides a replicable benchmark for what Douet (2025) calls "reading the urban landscape" at the intersection of remote sensing and heritage studies. Our research presents a case study of Antalya, along with a research methodology to examine historic areas experiencing urbanization challenges and determine whether the "Argo ship" dynamic exists across various cultural and planning systems.

## Conclusion

The results highlight the need for cautious urban planning and preservation initiatives to ensure the sustainable growth and protection of Antalya's historic area. This study adds to the expanding corpus of knowledge on the effects of urbanization on cultural assets and provides insights for upcoming conservation projects.

Kaleiçi contains numerous structures with economic, political, religious, and social significance. While these structures provide insight into the history of the period in which they were created, they also allow for various modern purposes. This study examined the shifting meanings of buildings from the past to the present, using urban semiotics and considering historical processes. When Kaleiçi, also known as the Ancient City of Attaleia, is examined through Roland Barthes' semiotic theory, it is not incorrect to define it as a metaphor for the Argo from Greek mythology. According to the mythology based on Apollonios of Rhodes' *Argonautika*, the Argo's occupants are Jason and the Argonauts, who are on a quest to acquire the Golden Fleece. Kaleiçi, like the miraculous ship built by Argos in the narrative, has remained the same, with minor adjustments over time, while its meaning has been continually updated.

Throughout history, societies have developed various systems to meet their needs and cultures. Because of its location, Kaleiçi has hosted multiple civilizations over the millennia, and the civilizations that resided here created structures in the city that bear signs of their respective cultures. Thus, the city has provided an opportunity to witness the cultural richness formed by different architectural monuments that work harmoniously.

While a port in Kaleiçi indicates that it is a bustling trading center, the city's baths demonstrate the significance that settlement peoples placed on socializing and hygiene throughout history. From a religious standpoint, the houses of worship can help us understand the shift from polytheism to Christianity and Islam.

The fact that each time produces different meanings in urbanization has made Kaleiçi a tourist destination. Ships that used to transport essential goods to Mediterranean international ports now travel small distances on tourist cruises

accompanied by popular music. The buildings along the road leading to the port have been converted into boutiques selling carpets, antiques, shoes, and bags, with some also serving as boutique hotels and hostels. Luxury restaurants and cafés line the port and its surroundings. Archaeologists hoped that their excavations in the ancient city, which is now a tourist attraction, would illuminate the identities of the civilizations that lived in the vicinity.

When satellite images were evaluated using the image-processing approach, it was found that Kaleiçi had an urbanization rate of only 5% over 20 years, indicating that change and transformation are slow. Designating the land as a historically protected area has significantly contributed to this scenario. According to Barthes, urban semiotics studies the social meaning or connotation of cultural objects in terms of ascribed values. The language of Antalya's ancient city, Kaleiçi, was examined using Roland Barthes' semiotic theory, following a brief overview of the field's current state. Results show that attempts have been made to protect Kaleiçi and that its historical and cultural significance has been recognized. The only thing that has changed throughout time is the meaning assigned to Kaleiçi, similar to Barthes' Argo ship metaphor: even if not every part is original, the ship remains in shape, and only the meaning is renewed. Like Barthes' metaphor of the Argo ship, the ship stays unchanged, even while parts of it have altered.

The research establishes an authentic validation method for remote sensing of urban heritage by comparing municipal conservation plans with cadastral records using change detection. The research verifies its RGB thresholds at 0.7 and 0.3 using a sensitivity analysis, while results demonstrate 92.4% accuracy in a manual digitization process. The mixed-methods framework of this study, which combines Barthesian semiotics and satellite image processing, enables researchers to examine how historic districts address urbanization while preserving their cultural heritage. The researchers should use the same sequential design (quantitative change detection → qualitative interpretation of denotation, connotation, and ideology) to other UNESCO sites that have tentative status or protected status to investigate whether the “Argo ship” dynamic

(material continuity with semantic renewal) holds under different planning regimes and tourism intensities.

Understanding the effects of urbanization in Antalya's historic district can be achieved through the use of urban semiotics and temporal satellite image processing. We can preserve the district's history, promote a strong sense of community identity, and engage in sustainable urban planning by clearly grasping how urban growth affects this special cultural place. Antalya's historic area can prosper by taking these steps while preserving its historical relevance for future generations.

## References

- Akiner, N., & Akiner, İ. (2014). A semiological analysis of an Old City: Reading the Antalya Kaleici. *Proceedings of the 2nd ICAUD International Conference in Architecture and Urban Design* (pp.353-363). Tiran, Albania.
- Al-Hadidi, S., Sweis, G., Abu-Khader, W., Abu-Rumman, G., & Sweis, R. (2023). Managing future urbanization growth patterns using genetic algorithm modeling. *Engineering, Construction and Architectural Management*. <https://doi.org/10.1108/ecam-08-2022-0776>
- Altamirano-Allende, C., & Selin, C. (2016). Seeing the city: photography as a place of work. *Journal of Environmental Studies and Sciences*, 6, 460-469. <https://doi.org/10.1007/s13412-015-0273-5>.
- Amjad, Z., Marij, Q., & Fatima, N. (2025). Graffiti, Public Art, and the metro-lingual City: A Semiotic Analysis of Urban Street Texts in Pakistan. *Pakistan Journal of Humanities and Social Sciences*, 13(4), 78-87. <https://doi.org/10.52131/pjhss.2025.v13i4.3300>
- Arias Álvarez, A. (2025). Graffiti and Urban transformation: the ideological discourse in the semiotic landscape of the Asturian Mining Valley. *Social Semiotics*, 1-23.

<https://doi.org/10.1080/10350330.2025.2451930>

- Atta, A. (2021). Scripts on linguistic landscapes: A marker of hybrid identity in urban areas of Pakistan. *Journal of Nusantara Studies (JONUS)*, 6(2), 58-96.
- Aygün, A. H., & Düzgün, A. C. (2021). Architectural Evaluation Analysis by Using GIS, Case Study: Kaleiçi, Antalya. *NEU Journal of Faculty of Architecture (NEU-JFA)*, 3(1), 59-67.
- Barthes, R. (1986). *Semiology and the Urban*. In *The city and the sign: An introduction to urban semiotics* (pp. 87-98). Columbia University Press.
- Barthes, R. (1988). *Semiology and urbanism*. *The semiotic challenge*, 191-201.
- Beaufort, S. (2002). Karamanya, (Suna-inan Kirac; Akdeniz Medeniyetleri Araştırma Enstitüsü çeviri Dizisi: 1, Antalya.
- Bern, A. (2023). Myths and imaginaries in architectural competitions. *Journal of Urban Design*, 28(1), 114-135.
- Bokhari, S., Saqib, Z., Amir, S., Naseer, S., Shafiq, M., Ali, A., Zaman-ul-Haq, M., Irshad, A., & Hamam, H. (2022). Assessing Land Cover Transformation for Urban Environmental Sustainability through Satellite Sensing. *Sustainability*, 14(5) 2810. <https://doi.org/10.3390/su14052810>
- Broadbent, G. (1980). A semiotic programme for architectural psychology. *Meaning and Behaviour in the Built Environment*, 313-359.
- Chandler, D. (1994). *Semiotics for beginners*. <http://visual-memory.co.uk/daniel/Documents/S4B/semiotic.html>
- Chang, R.A. (2021). How Do Scholars Communicate the 'Temporary Turn' in Urban Studies? A Socio-Semiotic Framework, *Urban Planning*, Volume 6, Issue 1, Page 133-145.
- Chhaya, S. V., Khera, S., & Kumar, P. (2015). Basic geometric shape and primary color detection using image processing on Matlab. *International Journal of Research in Engineering and Technology*, 4(5), 505-509.
- Cimrin, H., (1999). *Antalya Tarihi ve Turistik Rehberi*, Oteki Matbaası, Ankara
- Çoban, H. (2016). Roma Dönemi Hastaneleri, Asklepionlar ve Sarıkaya Roma Hamamı. *Uluslararası Bozok Sempozyumu Bildiri Kitabı-I. Cilt, Yozgat*, 98-109.
- Cooper, J. (2023). "I Guess You Could Call It Plant Racism": Making Kin in Australian Environmental Workfare. *Journal of Australian Studies*, 47(4), 688-705.
- Dayar, E. (2020). 1815 Haritası'nda Antalya Kalesi: Surlar, Kapılar ve Burçlar, *Belleten*, (84), 667-715.
- Dayar, E. (2023). Three Periods of Antalya in the 19th Century. *Adalya*, (26), 363-389.
- Diñç, G. (2016). Mehmet Ali Paşa İsyamı'nın Antalya'ya Etkileri (1831-1833), *Belleten*, (80), 857-884.
- Douet, J. (2025). Reading the Urban Landscape. In *The Meaningful City: Reading Barcelona's Urban Landscape* (pp. 1-18). Singapore: Springer Nature Singapore. [https://doi.org/10.1007/978-981-96-6755-0\\_1](https://doi.org/10.1007/978-981-96-6755-0_1)
- Duth, P. S., & Deepa, M. M. (2018). Color detection in RGB-modeled images using MATLAB. *International Journal of Engineering & Technology*, 7(2.31), 29-33.
- Eco, U. (1986). *Function and sign: semiotics of architecture*. In *The city and the sign: An introduction to urban semiotics* (pp. 55-86). Columbia University Press.
- Egresi, I., Bayram, B., Kara, F., & Kesik, O. A. (2012). Unlocking the potential of religious tourism in Turkey. *GeoJournal of Tourism and Geosites*, 9(1), 63-80.
- El-Amrousi, M., & Biln, J. (2013). Abu Dhabi Forms and Fragments: Muslim Space and the Modern City. *International Journal of Islamic Architecture*, 2(2), 349-367.

- Evslin, B. (2023). *Jason and the Argonauts*. Graymalkin+ ORM.
- Fachmi, A. (2025). Islamic Civilization and Science Representation in 1001 Inventions and the Library of Secrets: A Barthesian Semiotic Analysis. *Jurnal El-Pustaka*, 6(2), 99-113. <https://doi.org/10.24042/ev9g2r42>
- Fiske, J. & Hartley, J. (1978). *Reading television*. London: Methuen
- Giersig, N. (2008). Multilevel Urban Governance and the 'European City'. *Discussing Metropolitan Reforms in Stockholm and Helsinki*. Wiesbaden.
- Giuffrida, S., Napoli, G., & Trovato, M. R. (2018, May). The urban being between environment and landscape. On the old town as an emerging subject. In *International Symposium on New Metropolitan Perspectives* (pp. 378-386). Cham: Springer International Publishing.
- Goel, V., Singhal, S., Jain, T., & Kole, S. (2017). Specific color detection in images using RGB modelling in MATLAB. *International Journal of Computer Applications*, 161(8), 38-42.
- Goharipour, H., Gibson, H., & Latifi, G. (2021). Regardless if it is comedy, action, thriller, or biography: A review of urban crime in the 1980s cinema of Chicago. *Frontiers of Architectural Research*, 10(3), 555-571.
- Gottdiener, M., & Lagopoulos, A. P. (Eds.). (1986). *The City and the Sign: An Introduction to Urban Semiotics*. Columbia University Press.
- Güldüran, Ç. A., & Saltık, I. A. (2020). Sahnede şehirler! Türkiye'nin UNESCO Yaratıcı Şehirler Ağı-film alanı açısından değerlendirilmesi. *IBAD Sosyal Bilimler Dergisi*, Special Issue, 335-358.
- Güvenç, Ş. (1997). Antalya Kaleiçi'nde Yenikapı Gavur hamamı restorasyon projesi, Thesis (Master's Degree), Istanbul Technical University, Institute of Science and Technology.
- Hassenpflug, D., Giersig, N., Stratmann, B. (2011). *Reading the City: Developing Urban Hermeneutics (Stadt lesen: Beiträge zu einer urbanen Hermeneutik)*, Verlag der Bauhaus-Universität Weimar, Germany, ISBN: 978-3-86068-426-9
- Hosseini, A., & Barekat, B. (2025). A multimodal critical discourse analysis of city as text: investigation of meaning metafunctions of Rasht's Imam Khomeini Street. *Visual Communication*, 24(1), 90-113. <https://doi.org/10.1177/14703572221128886>
- Ijamaru, G. K., Nwajana, A. O., Oleka, E. U., Otuka, R. I., Ihianle, I. K., Ebenuwa, S. H., & Obi, E. R. (2021). Image processing system using MATLAB-based analytics. *Bulletin of Electrical Engineering and Informatics*, 10(5), 2566-2577.
- Irawan, N., Hesti, S., & Baihaky, R. (2025). Urban Cultural Representation in Student Photography: A Case Study of the "Warna-Warni Jakarta" Exhibition. *Greenation International Journal of Law and Social Sciences*, 3(2), 431-445. <https://doi.org/10.38035/gijlss.v3i2.455>
- Jankowska, A. (2019). Trade in the Mediterranean Basin between the 8th and 6th Century BCE, with Emphasis on the Dodecanese. *Acta Archaeologica Lodziensia*, (65), 131-137.
- Jiang, H. (2003). Stories remote sensing images can tell: Integrating remote sensing analysis with ethnographic research in the study of cultural landscapes. *Human Ecology*, 31(2), 215-232. <https://doi.org/10.1023/A:1023980713048>
- Kalaga, W. (2010). Face/façade: the visual and the ethical. *Town Planning and Architecture*, 34(3), 120-127.
- Kaya, G. T. (2022). Antalya Mevlevîhâne Müzesi'ndeki Mevlevîlik Kültürü ile İlgili Eserler Üzerine Bir Değerlendirme.

- Çanakkale Araştırmaları Türk Yılığ*, 21(33), 74-102.
- Khalil, M. A. M. A. (2026). Rethinking Urban Perception Through Linguistic Relativity a Review of Theoretical and Empirical Insights. *Integrative Psychological and Behavioral Science*, 60(1), 6. <https://doi.org/10.1007/s12124-025-09952-1>
- Kim, S., Fennimore, S., & Kim, D. (2022). A potential relationship between soil disinfestation efficacy and leaf green reflectance. *Plos One*, 17(7), e0271677. <https://doi.org/10.1371/journal.pone.0271677>
- Kior, A. (2024). RGB imaging as a tool for remote sensing of characteristics of terrestrial plants: a review. *Plants*, 13(9), 1262. <https://doi.org/10.3390/plants13091262>
- Kökmen Seyirci, H. & Alpaslan, H. (2022). *Lost Cultural Heritage: Antalya Kaleiçi (Old Town), Kesik Minaret: Past and Present*. Anatolian Landscape and Faith Tourism: Ancient Times to Present Conference (pp.1). Ankara, Turkey.
- Kozlovsky, R. (2019). Forking path: Describing interchange architecture at the Ayalon Crosstown Expressway. *Frontiers of Architectural Research*, 8(3), 332-347.
- Krampen, M. (2013). Meaning in the urban environment. Routledge.
- Lagopoulos, A. P. (2019). The semiotics of urban space. In *The Routledge companion to urban media and communication* (pp. 23-35). Routledge.
- Lagopoulos, A. P. 2018. Land-use planning methodology and middle-ground planning theories. *Urban Science*, 2(3), 93.
- Levin, A. (2016). Basic Design and the Semiotics of Citizenship: Julian Beinart's Educational Experiments and Research on Wall Decoration in Early 1960s Nigeria and South Africa. *ABE Journal. Architecture beyond Europe*, (9-10).
- Lynch, K. (1960). *The image of the city*. MIT Press.
- Lynch, K. (1984). *Reconsidering the image of the city* (pp. 151-161). Springer US.
- Mansuroğlu, S., Dağ, V., Kösa, S., & Demir, F. (2021). Korunan alanlarda turizmin etkisi: Antalya kenti örneği. *Atatürk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 25(1), 215-232.
- Millán-Gómez, A., & Birgonul, Z. (2018). Barcelona and Antalya. Cartographic Analysis of Two Mediterranean Cities. In *Architectural Draughtsmanship: From Analog to Digital Narratives 16* (pp. 1109-1117). Springer International Publishing.
- Mills, P. (2022). Wanting Austin Inside Out: Viral Poetics and Queer Theory. *European Society for Aesthetics*, 14.
- Mounin, G., Beeman, W., Deręowski, J., Heft, H., Maxwell, R., Moore, K., Newton, M., Schwartz, A., Thornton, R., Tuan, Y., & Yamamoto, A. (1980). The Semiology of Orientation in Urban Space [and Comments and Reply]. *Current Anthropology*, 21, 491 - 501. <https://doi.org/10.1086/202498>
- Nas, P. J. (2011). Cities full of symbols: a theory of urban space and culture (p. 304). Leiden University Press.
- Nasir, O., & Kamal, M. A. (2021). Vernacular Architecture as a Design Paradigm for Sustainability and Identity: The Case of Ladakh, India. *American Journal of Civil Engineering and Architecture*, 9(6), 219-231.
- Ottoman State Archives: BOA, DH.MKT., Box No: 421, Queue No: 61.
- Özgönül, N. (2015). The Turkish Involvement in the 1975 European Architectural Heritage Year and its Impact on Heritage Conservation in Turkey. *Monumenta*, 3, 332-345.
- Paül, V., Vila-Lage, R., & Trillo-Santamaria, J. M. (2022). "The n° 1 country"? A critical investigation of the booming designation of

- biosphere reserves in Spain. *Landscape and Urban Planning*, 222, 104375.
- Pauwels, L. (2009). Street discourse: A visual essay on urban signification. *Culture Unbound*, 17, 263-272.
- Raaphorst, K. (2018). Knowing your audience: the contingency of landscape design interpretations. *Journal of Urban Design*, 23(5), 654-673.
- Robinson, J., & Roy, A. (2015). Global Urbanisms and the Nature of Urban Theory. *International Journal of Urban and Regional Research*, 40(1), 181-186. <https://doi.org/10.1111/1468-2427.12272>.
- Samorè, I. (2025). Religious Buildings, Cultures, Spatiality: New Urban Narrations Between Semiotics and an Intercultural Application of Law. *International Journal for the Semiotics of Law-Revue internationale de Sémiotique juridique*, 38(4), 1173-1186. <https://doi.org/10.1007/s11196-024-10181-9>
- Savoye, D. F. (2011). Urban Spaces in Dystopian Science Fiction. *Ángulo Recto: Revista de estudios sobre la ciudad como espacio plural*, 3(2), 133-149.
- Seçilmişler, T., Özügül, M. D., & Yerliyurt, B. (2015). An Essay on Reading the Change of Cultural Heritage Components Through Semantic Literature: *Historical Mesires in Istanbul. Megaron*, 10(2).
- Seress, G., Lipovits, Á., Bókony, V., & Czúni, L. (2014). Quantifying the urban gradient: A practical method for broad measurements. *Landscape and Urban Planning*, 131, 42-50. <https://doi.org/10.1016/J.LANDURBPLAN.2014.07.010>.
- Singh, P., Alsadoon, A., Prasad, P. W. C., Venkata, H. S., Ali, R. S., Haddad, S., & Alrubaie, A. (2020). A novel augmented reality to visualize the hidden organs and internal structure in surgeries. *The International Journal of Medical Robotics and Computer Assisted Surgery*, 16(2), e2055.
- Smith, P., & Riley, A. (2008). *Cultural theory: An introduction*. John Wiley & Sons.
- Solomon, O. (1988). Semiotics and marketing New directions in industrial design applications. *International Journal of Research in Marketing*, 4, 201-215. [https://doi.org/10.1016/S0167-8116\(88\)80005-3](https://doi.org/10.1016/S0167-8116(88)80005-3).
- Soydan, O. (2020). Examination of Urban Values of Kaleiçi Old Town In Terms Of Landscape Architecture and Suggestions for Effective Use of Historical Sites. *Ege Üniversitesi Ziraat Fakültesi Dergisi*, 57(3), 401-411.
- Stojiljković, D., & Ristić Trajković, J. (2018). Semiotics and urban culture: architectural projections of structuralism in a socialist context. *Social semiotics*, 28(3), 330-348.
- Suboticki, I., & Sørensen, K. H. (2021). Designing and domesticating an interstructure: Exploring the practices and the politics of an elevator for cyclists. *Urban Studies*, 58(6), 1229-1244.
- Sujan, M., Alam, N., Noman, S. A., & Islam, M. J. (2016). A segmentation based automated system for brain tumor detection. *International Journal of Computer Applications*, 153(10), 41-49.
- Tızlak, F. (2002). Tekelioğlu İsyanı. XIII. Turkish History Congress, (4-8 October 1999), 239-254, Ankara: Turkish Historical Society Publications.
- Todd, L. (2022). Semiotics of Edinburgh's Festival City Place-Myth: Management and community stakeholders' visual representations of festival spaces. University of Westminster Press.
- Vimal, R., Géniaux, G., Pluvinet, P., Napoléone, C., & Lepart, J. (2012). Detecting threatened biodiversity by urbanization at regional and local scales using an urban sprawl simulation approach: Application on the French Mediterranean region. *Landscape and Urban Planning*, 104, 343-355.

<https://doi.org/10.1016/J.LANDURBPLAN.2011.11.003>.

46598.

<https://doi.org/10.1109/ACCESS.2022.3171585>

- Wang, B., Choi, J., Choi, S., Lee, S., Wu, P., & Gao, Y. (2017). Image fusion-based land cover change detection using multi-temporal high-resolution satellite images. *Remote Sensing*, 9(8), 804. <https://doi.org/10.3390/rs9080804>
- Wyly, E. (2022). Racial Evolution of an Urban Planet: Scenes From the North American Frontier. *Frontiers in Sustainable Cities*, 4, 835797.
- Yanow, D. (2015). How built spaces mean: A semiotics of space. In *Interpretation and method* (pp. 368-386). Routledge.
- Yanushkevich, I. (2014). Semiotics of social memory in urban space: the case of Volgograd (Stalingrad). *International Journal of Cognitive Research in Science, Engineering and Education (IJCRSEE)*, 2(1), 43-50.
- Yılmaz, L. (2002). *Antalya: Bir Ortaçağ Türk Şehrinin Mimarlık Mirası ve Şehir Dokusunun Gelişimi: 16. Yüzyılın Sonuna Kadar*. Ankara: Turkish Historical Society Publications.
- Yu, D. (2025). Toward integrated urban observatories: synthesizing remote and social sensing in urban science. *Remote Sensing*, 17(12), 2041. <https://doi.org/10.3390/rs17122041>
- Yussupova, A. A., Songfu, L., Namazbay, A., Rahimian, F. P., & Nejad Ebrahim, A. (2017). Ornamental art and symbolism: activators of historical regeneration for Kazakhstan's landscape architecture. *International Journal of Architectural Research: ArchNet-IJAR*, 11(3), 193-213.
- Zhang, L., Lin, H., & Wang, F. (2022). Individual Tree Detection Based on High-Resolution RGB Images for Urban Forestry Applications. *IEEE Access*, 10, 46589-