

An Application of the Polynomial Regression Algorithm for Predicting the Effects of Coastal Erosion at Bang Khun Thian

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Abstract

The problem of coastal erosion in Bang Khun Thian, Bangkok has resulted in people being forced to retreat or relocate, causing significant impacts on their livelihoods and way of life. To address this issue, a system is aimed to be developed by researchers that can measure and predict the likelihood of coastal erosion patterns in the future using the Polynomial Regression Algorithm based on water flow data, wind speed, and direction measurements. It was found from the experiment that a relatively high accuracy was yielded by the model when compared to the current erosion rates in 2023, and a high level of accuracy is expected to be achieved in predicting erosion for the next 50 years, particularly in the year 2073. With the help of this system, timely prevention and management measures can be taken to reduce the impacts of coastal erosion on the environment, economy, tourism, safety, and people's way of life.

Research Question and Hypothesis

1. The amount of sediment in the water in relation to wind speed and direction indicates trends and patterns of future shoreline erosion.
2. How wind speed and direction are related to the rate of shoreline erosion.
3. How the amount of sediment in the water is related to the rate of shoreline erosion.
4. How to create a math model using Polynomial Regression Algorithm to predict accurately.

Introduction and Review of Literature:

The ecosystem has a relationship between living organisms and the environment. Currently, the problem of housing impacted by natural disasters has increased in severity, particularly the issue of coastal erosion that occurs in areas along the coastline. This creates significant damage to the environment, the economy, tourism, safety, and even affects the way of life for people. The problem of coastal erosion in Bang Khun Thian, Bangkok, over the past 10 years has caused people to retreat or relocate, resulting in significant impacts on their livelihoods and way of life.

Coastal erosion is a difficult problem to observe as it occurs gradually, making it challenging to prevent and manage effectively. The researchers, therefore, aim to develop a system that can measure and predict the likelihood of coastal erosion patterns in the future through the use of Polynomial Regression Algorithm based on water flow data, wind speed, and direction measurements. This system can help with timely prevention and management measures.

Research Methods and Materials

The Landsat 9 satellite images of the Bang Khun Thian coastline were used to crop and identify the current coastline using image processing. The sea areas were changed to black, and the pixels before the sea were changed to white, resulting in the identification of the coastline. Polynomial regression algorithm was then used to predict the likelihood of future coastal erosion patterns by inputting 900 white pixels of satellite images taken at band 5 each year for the past 10 years, along with water turbidity, wind speed, and direction measurements. The output values were plotted onto the current satellite images of Bang Khun Thian in 2566 BE. The resulting

output values were compared to the previous years, and if the pixel distance exceeded the set value, it was highlighted in yellow to indicate severe erosion, and green was used to indicate mild erosion.

Results

The Polynomial Regression Model applied with satellite imagery data, underwater turbidity, wind speed, and wind direction retrospectively yielded a relatively high accuracy when compared to the current erosion rates in 2023. This enables us to confidently anticipate a high level of accuracy in the model's predictions for the next 50 years, particularly in the year 2073 .

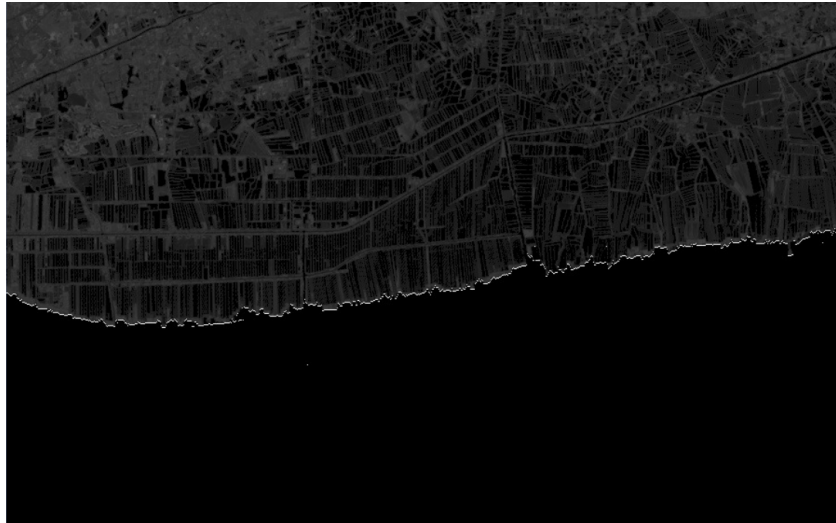


Figure 1: The erosion of the shoreline in Bang Khun Thian area at present (2023)

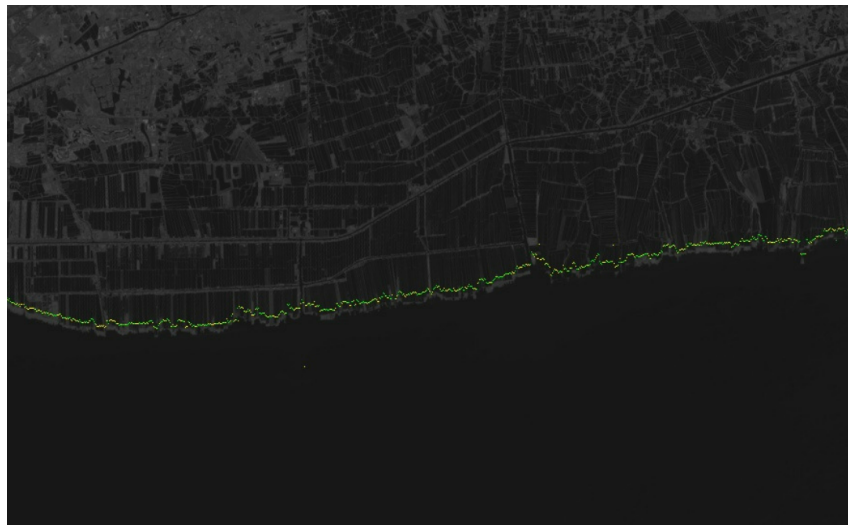


Figure 2 : The erosion in the shoreline of Bang Khun Thian in the year 2073

(Green color: mild erosion, Yellow color: severe erosion).

Discussion:

Overall, the proposed system offers a promising approach to tackle the issue of coastal erosion. By providing a more accurate understanding of erosion patterns, policymakers and relevant authorities can take timely and effective measures to mitigate the impacts of coastal erosion. This could include strategies such as beach nourishment, artificial reefs, or other forms of coastal protection. Ultimately, the implementation of this system can help ensure the sustainability and resilience of coastal communities and their environments.

Conclusion:

The problem of coastal erosion in Bang Khun Thian, Bangkok, which has forced people to retreat or relocate, resulting in significant impacts on their livelihoods and way of life. To address this issue, researchers are developing a system that can measure and predict the likelihood of coastal erosion patterns in the future. The system uses the Polynomial Regression Algorithm based on water flow data, wind speed, and direction measurements to yield a relatively high accuracy in predicting erosion for the next 50 years, particularly in the year 2073. The Landsat 9 satellite images were used to crop and identify the current coastline using image processing. The resulting output values were compared to the previous years, and if the pixel distance exceeded the set value, it was highlighted in yellow to indicate severe erosion, and green was used to indicate mild erosion. By using this system, timely prevention and management measures can be taken to reduce the impacts of coastal erosion on the environment, economy, tourism, safety, and people's way of life.

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Badge Descriptions/Justifications:



I Make an Impact

Our research on coastal erosion in Bang Khun Thian, Bangkok has the potential to bring about significant positive impacts on the local community. By addressing the issue of coastal erosion, we can protect homes and infrastructure, thus preventing damage and ensuring the safety and security of residents. The preservation of natural resources such as beaches, wetlands, and coral reefs is also critical for supporting local industries such as tourism and fishing, which play an important role in the economy of the region.

Coastal erosion can have a wide range of negative impacts on the quality of life for residents, including the loss of access to beaches, increased flooding, and other environmental hazards. Our research can mitigate these impacts and help to improve the overall well-being of the community. By understanding the causes and effects of coastal erosion and implementing effective solutions, we can reduce the negative impacts of erosion and promote a sustainable future for the community.

Implementing sustainable development strategies is also an essential aspect of addressing coastal erosion. By building sea walls, planting vegetation to stabilize the shoreline, or other effective measures, we can protect the environment while supporting economic growth. This approach can create a positive impact on the community in the long run by promoting sustainable practices and reducing the negative impact of erosion on the community's social, economic, and environmental well-being.

In summary, our research on coastal erosion in Bang Khun Thian, Bangkok is crucial in mitigating the negative impacts of erosion on the community's quality of life, economy, and environment. Our findings can lead to the implementation of effective solutions that can protect homes and infrastructure, preserve natural resources, and promote sustainable development.



I am a STEM Storyteller

As a scholarship student, I am passionate about making a positive impact in my community, and one way I can do this is by raising awareness of the issue of coastal erosion. To share the story of my research in a creative way, I could use various methods to engage the audience and make the information more accessible and understandable.

One approach could be to create a short documentary or video that highlights the causes and effects of coastal erosion in my local community. The video could include interviews with residents and experts, as well as footage of affected areas, to provide a

firsthand look at the impacts of erosion. By using visual elements and storytelling techniques, the video can make a compelling case for the need to address this issue.

Another creative approach could be to organize a community event or exhibition that showcases the findings of my research. This could include interactive displays, presentations, and hands-on activities that educate and engage attendees. By involving the community in the research process and making the information more accessible, I can foster a sense of ownership and inspire action to address the issue of coastal erosion.

Overall, there are many ways to creatively share the story of my research and raise awareness of the issue of coastal erosion in my community. By using a variety of methods to engage and educate the audience, I can make a meaningful contribution to the well-being and sustainability of my community.