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GAN-BASED FLOOD VISUALIZATION SYSTEM USING IMAGE TRANSLATION

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ABSTRACT

Enhanced adaptation strategies are required as a consequence of environment's increased severity of natural catastrophes. As climate change is a major threat to mankind, individual behavior adjustments are necessary to avert its disas-trous effects. Bringing the prospective effects of extreme weather events, like floods, more tangible in familiar settings might help and make the abstract effects of climate change more tangible. The project aims to increase public understanding of how, due to its influence in extreme weather events and rising seas, climate change is increasing the risk of floods globally. GAN was used to create a website that projects catastrophic climate disasters onto user-chosen images and locales. Additionally, it makes use of ML models to forecast floods and their effects. In this study, we explain the complexities of our system and demonstrate how well our model generates photorealistic floods and forecasts future floods using weather forecast data.

Keywords: Generative Adversarial Network (GAN), Image Translation, Floods, Random Forest Classifier.

I. INTRODUCTION

Climate change is becoming a more significant threat to our world, with rising temperatures producing extreme weather events like droughts, storms, and heatwaves. Droughts, storms, and heatwaves are all caused by our planet's growing temper-atures. Millions of individuals throughout the world, whose numbers are growing annually, are impacted by these occur-rences. It has been discovered that visualizing the implications of climate change might assist overcome distancing, a psycho-logical characteristic that causes climate change to be regarded as distant, uncertain, and hence less likely to elicit action. The goal of our project is to raise awareness of how climate change may impact one's personal environment by using GANs to generate images of these potential impacts. Currently, we are focusing on generating images of one specific extreme climate event: floods. Starting with a street-level image, we use unsupervised image-to-image translation techniques to alter it to reflect the impacts of climate change. Our goal was to predict floods from weather data using machine learning. For prediction we used information about past and current floods in India, as well as their date and location. We then used the Visual Crossing weather API to obtain historic weather data such as precipitation, humidity, temperature, cloud cover, and windspeed in those areas and during those times. We also performed several data augmentation techniques on this data set, which enabled us to significantly increase the diversity of data available for our training model, without collecting new data. We tried various machine learning models from Logistic Regression to K-Nearest Neighbors to Random Forest Classification.

We display this information in an interactive graphical format, making the information compelling and easy to un-derstand for people and governments alike. In this research, we present the intricacies of our framework, and show that our model can generate photorealistic floods and predict future floods based on weather forecast data in a robust manner.

II. LITERATURE SURVEY

Hofmann, Julian Sch uttrumpf, Holge [1] provides a com-prehensive review on the use of deep adversarial learning for pluvial flooding prediction. The paper highlights the per-formance and evaluation of floodGAN, identifies challenges, and suggests future directions for research in this field. Overall, this paper contributes to the existing literature on flood prediction and provides valuable insights for researchers and practitioners interested in leveraging machine learning techniques for urban flood resilience.

M. Khalaf [2] analyze existing flood prediction methodolo-gies and proposes a data-driven approach based on machine learning algorithms. The paper highlights the potential of machine learning for accurate and reliable flood severity pre-diction and identifies challenges and future research directions.

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Cosne, G., Juraver, A., Teng, M., Schmidt, V., Vardanyan, V.T., Luccioni, A.S., Ben-gio, Y. [3] presents a novel approach for generating images of climate change using simulated data. The paper provides a literature review on traditional approaches for visualizing climate change and highlights the potential benefits and applications of using simulated data for image generation. The paper also identifies challenges and future research directions in this area.

Schmidt, Victor Luccioni, Alexandra Teng [4] presents an innovative approach for generating flood-related images using GANs to raise awareness about the impacts of climate change. The paper provides a literature review on traditional approaches for visualizing climate change and highlights the potential benefits and applications of using GANs for gener-ating flood-related images.

Y. Lin, Y. Li, H. Cui and Z. Feng [5] presents a novel approach for weather image translation using GANs, and provides a literature review on existing methods, potential benefits, applications, and challenges in this area. The paper identifies challenges in using GANs for weather image transla-tion, such as the difficulty of capturing complex and dynamic weather patterns and the potential biases in the generated images. The authors suggest future research directions, such as improving the accuracy and diversity of the translated images, validating the translated images with observational data, and exploring ways to address the challenges in multidomain weather image translation.

Brandon Requena-Mesa, Christian Chishtie, Farrukh Diaz Rodriguez [6] emphasize the need for further research in devel-oping physics informed GANs for coastal flood visualization, including addressing challenges related to data availability, model interpretability. It highlights the potential of physics informed GANs as a promising approach for generating real-istic flood visualizations with improved accuracy and provides insights for future research in this area.

III. PROPOSED METHODOLOGY

By utilising the Python beautiful-soup 4 package to scrape the floodlist website, the dataset used for flood prediction is produced. This website gave us details about floods that had occurred in India in the past and now, along with their date and location. We then obtained historical weather information for those locations and for those periods, including precipitation, humidity, temperature, cloud cover, and windspeed, using the Visual Crossing weather API. For this data set, we also applied a number of data augmentation techniques, which allowed us to greatly expand the variety of data that was accessible for our training model. In order to replace non-flooded images with photorealistic flooded images, a GAN-based image to image translation model was also developed. The website allows users to view flood predictions and flooded versions of their chosen images.

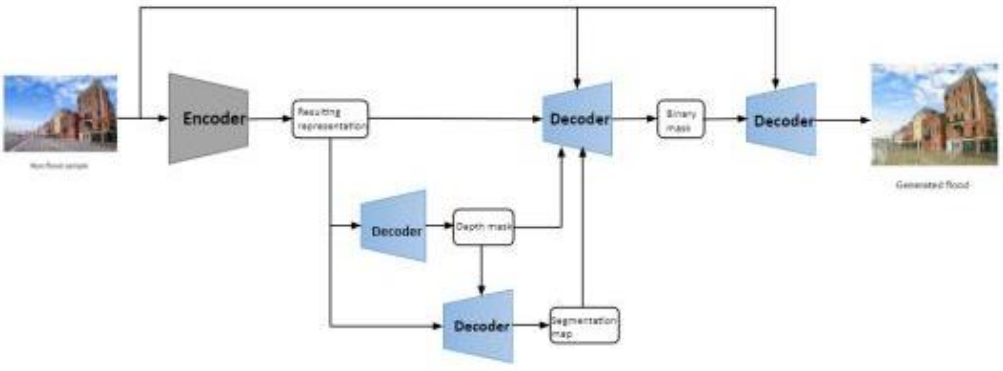

Fig. 1. Architecture of image translation model

IV. CONCLUSION

In this work, we put up the idea of predicting floods using a machine learning algorithm. It is a web application that allows users to see prediction of floods to anticipate future floods based on meteorological forecast data such as precipitation, wind speed, humidity, temperature, and cloud cover. Also, we are performing image translation on non-flooded image using GAN to covert it to it's flooded version.

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V. FUTURE SCOPE

By this review of the literature, we have come to the conclusion that by providing a more realistic output image and a more precise prediction, we may further broaden the scope of our project. To improve the forecasting of floods, we can also concentrate on studying more weather factors. This would enhance the flood prediction and make it more exact and accurate.

VI. REFERENCES

[1] Hofmann, Julian Schuttrumpf,¨ Holger. (2021). floodGAN: Using Deep Adversarial Learning to Predict Pluvial Flooding in Real Time. Water. 13. 2255. 10.3390/w13162255.

[2] M. Khalaf et al., "A Data Science Methodology Based on Machine Learning Algo- rithms for Flood Severity Prediction," 2018 IEEE Congress on Evolutionary Computation

[3] (CEC), 2018, pp. 1-8, doi: 10.1109/CEC.2018.8477904.

[4] Cosne, G., Juraver, A., Teng, M., Schmidt, V., Vardanyan, V.T., Luccioni, A.S., Ben- gio, Y. (2020). Using Simulated Data to Generate Images of Climate Change. ArXiv, abs/2001.09531.

[5] Schmidt, Victor Luccioni, Alexandra Teng, Melisande´ Zhang, Tianyu Reynaud,

[6] Alexia Raghupathi, Sunand Cosne, Gautier Juraver, Adrien Vardanyan, Vahe Hernandez- Garcia, Alex Bengio, Y.. (2021). ClimateGAN: Raising Climate Change Awareness by Generating Images of Floods.

[7] Y. Lin, Y. Li, H. Cui and Z. Feng, "WeaGAN:Generative Ad-versarial Network for Weather Translation of Image among Multi-domain," 2019 6th International Conference on Behavioral, Eco-nomic and Socio-Cultural Computing (BESC), 2019, pp. 1-5, doi: 10.1109/BESC48373.2019.8963257.

[8] Lutjens,¨ Bjorn¨ Leshchinskiy, Brandon Requena-Mesa, Christian Chishtie, Farrukh Diaz Rodriguez, Natalia Boulais, Oceane´ Pina,˜ Aaron Newman, Dava Lavin, Alexander

[9] Gal, Yarin Ra¨ıssi, Chedy. (2020). Physics-informed GANs for Coastal Flood Visualiza- tion.

[10] Huang, X., Liu, M.-Y., Belongie, S., and Kautz, J. Multimodal Unsuper-vised Image-to-Image Translation. arXiv:1804.04732 [cs, stat], August 2018. arXiv: 1804.04732

[11] Chen, Shihui & Xu, Mingyao & Yu, Fan. (2022). Semantic Region-Adaptive Normalization for Image Synthesis and Editing.

[12] Yi, Zili & Zhang, Hao & Tan, Ping & Gong, Minglun. (2017). Du-alGAN: Unsupervised Dual Learning for Image-to-Image Translation. 2868-2876. 10.1109/ICCV.2017.310.

[13] Li, X., Kou, K., and Zhao, B. Weather gan: Multi-domain weather translation using generative adversarial networks. arXiv preprint arXiv:2103.05422, 2021.

[14] Mo, Sangwoo & Cho, Minsu & Shin, Jinwoo. (2018). InstaGAN: Instance-aware Image-to-Image Translation.

[15] Mirza, Mehdi & Osindero, Simon. (2014). Conditional Generative Adversarial Nets.

[16] Leviston, Zoe & Price, Jennifer & Bishop, Brian. (2014). Imagining climate change: The role of implicit associations and affective psy-chological distancing in climate change responses. European Journal of Social Psychology. 44. 10.1002/ejsp.2050.