Analysis Report

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| **Project: Prevention of alleyway accidents with MOG2 algorithm and GIS analysis.** |
| **The Details** |

**◦** Analysis overview

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| ◦ Analysis result details |
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Geographic Information System (GIS)  We identified the trend of traffic accidents in Gangseo-gu and analyzed the accident rate and population density. In this process, a GIS that can visually emphasize the relationship between traffic accidents and population density was adopted.  GIS modeling provides various types of information necessary for decision-making by finding hidden patterns and relationships in spatial phenomena. Based on this, it is an analysis method that derives solutions and predicts space changes.  By integrating and managing location data and attribute data for objects with geographic locations, it is possible to identify problems based on analysis of inter-information such as maps and diagrams and to derive various insights into space by grasping predictions and trends.  B. MOG (Mixture of Gaussian)  MOG is one of the algorithms that remove the background in real-time in the process of image analysis and is very effective and often used. The MOG algorithm based on the Gaussian mixture model sets a probabilistic model for each pixel in the image to distinguish objects in the background and foreground. We chose the MOG2 algorithm based on the Gaussian mixture model to remove the static background and track the motion of an object as a method for analyzing CCTV images.    [Figure 1] Object Recognition Flowchart  MOG2 is a model that will develop the Gaussian distribution of MOG, has an excellent background and foreground segmentation performance, and shows high adaptability in various environments where light changes occur. In addition, since shadow detection is possible, there is an advantage in that objects can be accurately distinguished. In the image analysis process, the MOG2 algorithm was used to compare the current and previous frames as shown in [Figure 1], remove the static part, extract only the part where the change occurred and express it in white, and use the outline for the part expressed in white. This increases the recognition rate of objects.  object recognition sequence   1. Sequentially extract images from video frames. 2. After changing the extracted image to a black-and-white image to improve performance, set the desired detection section. 3. Using MOG2, remove the static background to black and remove the moving object and extracted it to white. 4. Emphasizing necessary objects through the closing technique and preventing noise expansion at the same time. 5. Through the opening technique, the object is protected as much as possible, and noise is removed. 6. The recognition rate is increased by applying the dilation calculation twice to highlight the object. 7. When the recognized object is entering the detection area after creating a green outline on the recognized object, a warning signal shows up on the screen.   3. Analysis Methodology  A. planning stage   1. Contribute to improving the welfare of residents using Gangseo-gu public data 2. Check CCTV location and illegal parking location data for peace of mind among public data   - Hypothesis: increase in traffic accidents due to an increase in illegal parking  - Proposal: To reduce traffic accidents, provide an alternative using CCTV for relief  B. data preparation   1. Collecting public data such as public data portal and Seoul public data 2. TAAS data collection for the data collection on traffic accidents   C. data analysis   1. Pre-process (EDA) TAAS data and analyze associations for each variable 2. Finding meaningful data 3. Additional data collection based on analysis results 4. (Administrative-dong boundary, Gangseo-gu population, CCTV video data, etc.) 5. Repeat the preparation and analysis steps to the desired level   - Visualize preprocessing (EDA) data  - Analyze visualization data  - Check the basis for the hypothesis  D. system implementation   * 1. Start constructing a model to realize our team's proposals for the hypothesis   2. Build the desired model through the background removal algorithm with the collected image data   E. Model evaluation and analysis   1. Confirmation and verification of proposals | |

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| **◦ Results and implications** |
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| **◦ Utilization plan and expected effect** |
| |  | | --- | | 1. Utilization sector  One of the biggest causes of traffic accidents is the driver's blind spot. If you check the result of GIS analysis of traffic accident data, you can see that a lot of traffic accidents occur not only on the roadside where there are many vehicles but also at intersections and daily roads where the driver's line of sight is not secured.  Assuming a traffic accident occurs at an alleyway intersection, it is difficult for drivers and pedestrians to immediately recognize the situation on the left and right sides of the road due to blind spots of view. From the driver's point of view, a traffic accident may occur due to a vehicle or pedestrian suddenly appearing from the blind spot. As a way to solve this problem, we devised a road keeper notification system that recognizes the movement of pedestrians and vehicles in the driver's blind spot based on AI analysis and notifies the driver of the risk of an accident through a warning light.  Relief installed in road intersection areas such as crossroads or three-way intersections, which are frequent traffic accident sections, analyzes the movement of objects and people in the CCTV video data by AI analysis to ensure that vehicles or pedestrians entering from the right or left side of the driver are detected at the intersection. When approaching within a certain distance, a warning light is turned on.  2. Expected effect  The road keeper notification system provides information about blind spots in the front sight by installing a warning light that can notify the driver or pedestrian of the surrounding situation when a movement of an object is confirmed based on the result of analyzing the image.  Through this, it is expected that it will be possible to reduce the incidence of accidents in the alley intersection section by giving drivers attention to the accident situation in advance and recognizing the causes of the accident.  Another expected effect is cost reduction. The existing relief installed in Gangseo-gu is expected to reduce the system’s cost by analyzing the CCTV images through the MOG2 analysis system. [Figure 7] shows that the recognition range based on the location of the security camera (●) and the area where the traffic accident occurred (●) overlap.    [Figure 7] The intersection range of the traffic accident area and the safety CCTV  In addition, it can be used in various ways not only in alleys and living roads with many parking lots but also in places where visibility is difficult, such as alleys entering the roadside. If Hwagok-dong, which has a high population density and many roads for a living, is selected as a pilot area, the effectiveness of the road guard system by the MOG2 algorithm can be identified within a short period. | |

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| **◦ Sources of utilization data and references** |
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