Algorithms for Motion Tracking in Real-Time Applications

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ABSTRACT

Tracking of objects in motion is a process that seems to be automatically performed by the brain. Humans are so good at visually tracking a moving object in a stationary background that the task seems easy and straight forward; however, replicating object tracking in computers can require complex algorithms and high computing power. Therefore, research on this subject is oriented towards the creation of models and algorithms that perform tracking efficiently. In this paper, we present a simple algorithm to track the motion of objects using vector physics and image processing techniques. In his algorithm "anomalies" are found in a single frame and then grouped. The same is repeated for successive frames. Then correlation of anomalies between frames is computed to establish a moving trend and estimate the position of next anomaly in the frames to follow. After the correlation is calculated, the estimated object path is stored in an output array. The results are quite promising. Using the algorithm, complex and longer trajectories can be successfully tracked, as the prediction accuracy of future object path increases with information from previous estimated directional motion.

SIGNIFICANCE

- Motion tracking is of interest to many government and private industries for surveillance, security and control
- Improved algorithms are needed to efficiently track moving objects under adverse environmental conditions
- Tracking algorithms will improve vision-based recognition capabilities of robots

MOTIVATION

- Understand existing algorithms for motion tracking
- Improve and develop algorithms for future applications in

  Determine traffic flow

  Track people and predict their position

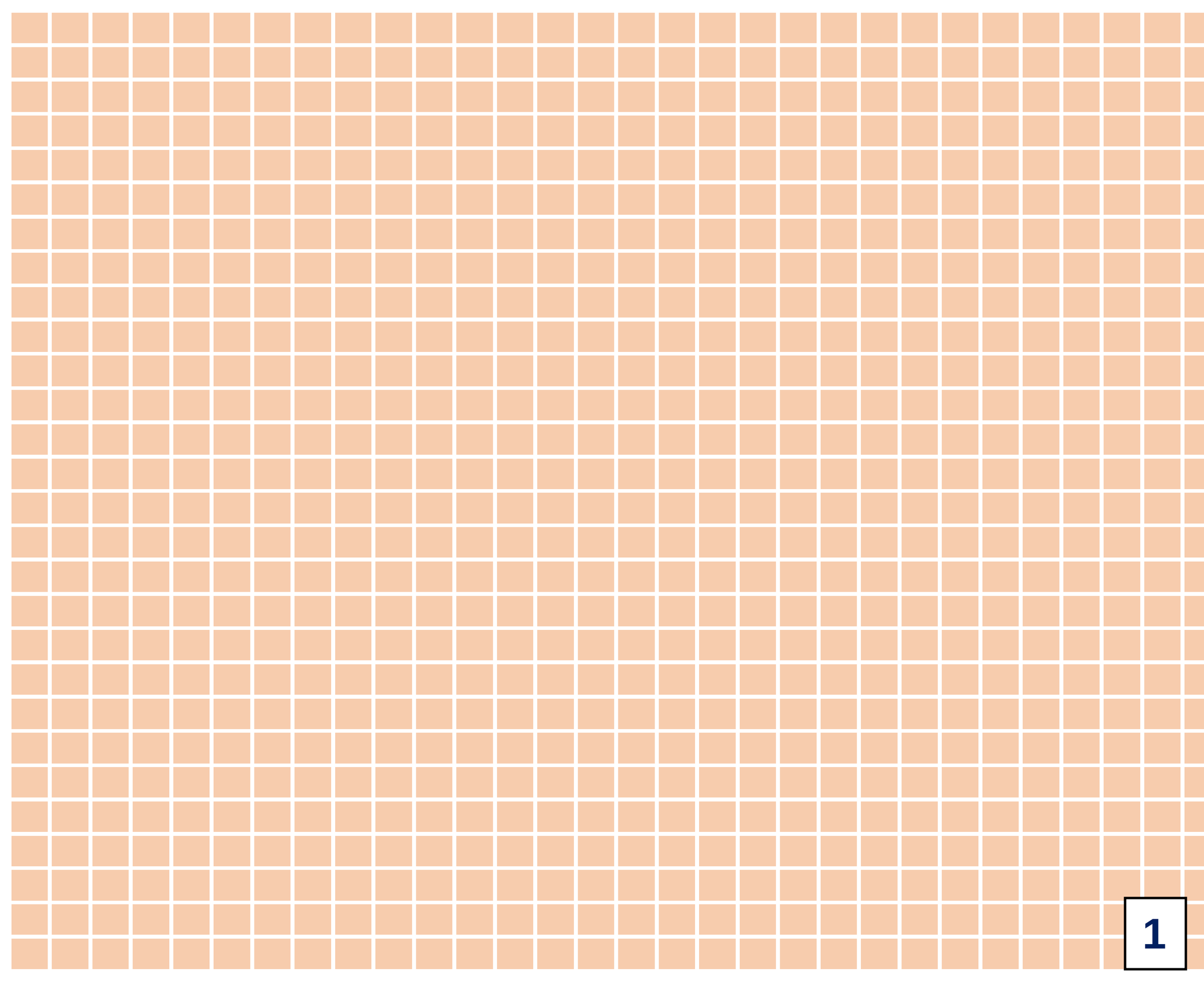
  - Combine with AI to improve accuracy

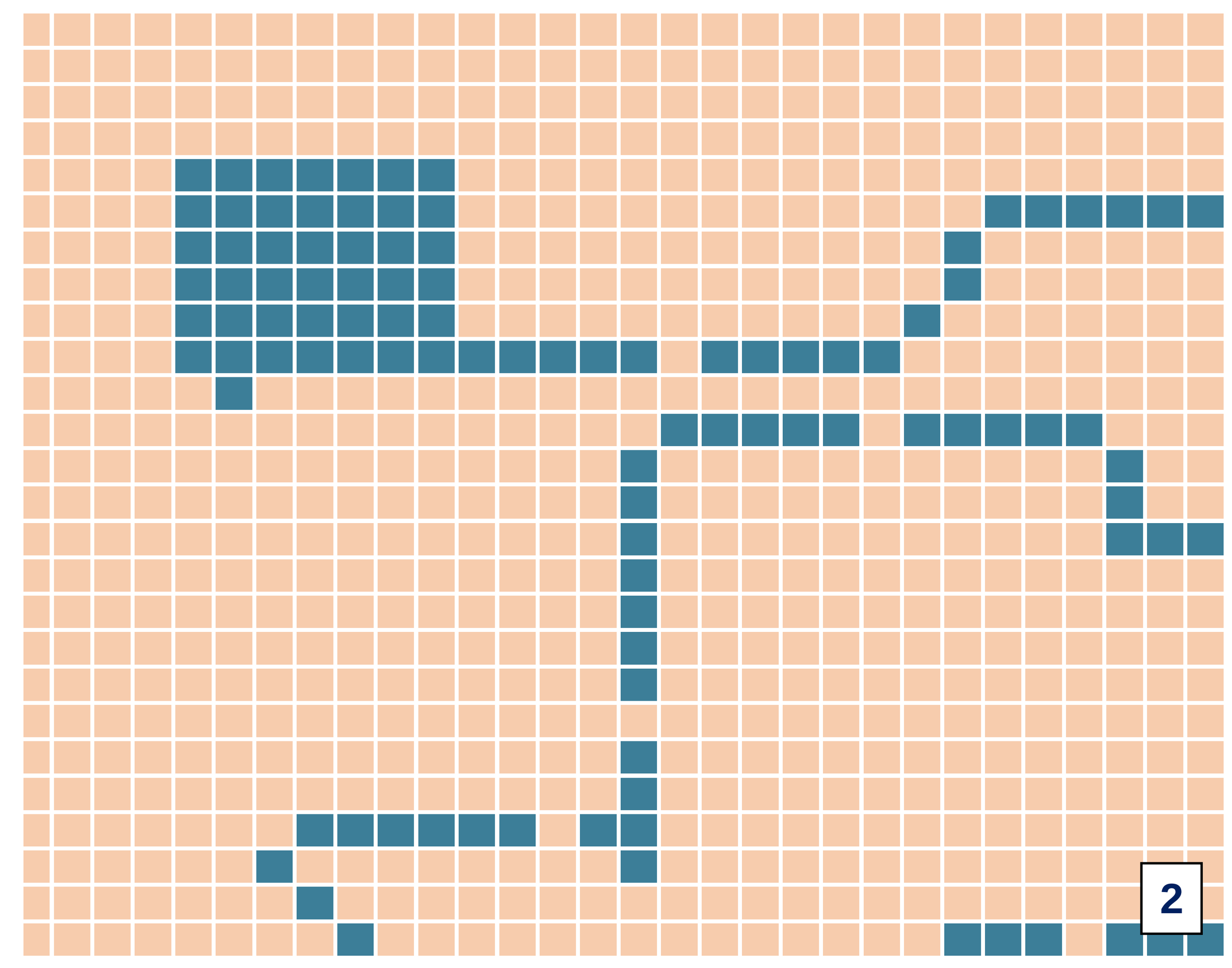
MULTI-OBJECT TRACKING ALGORITHM

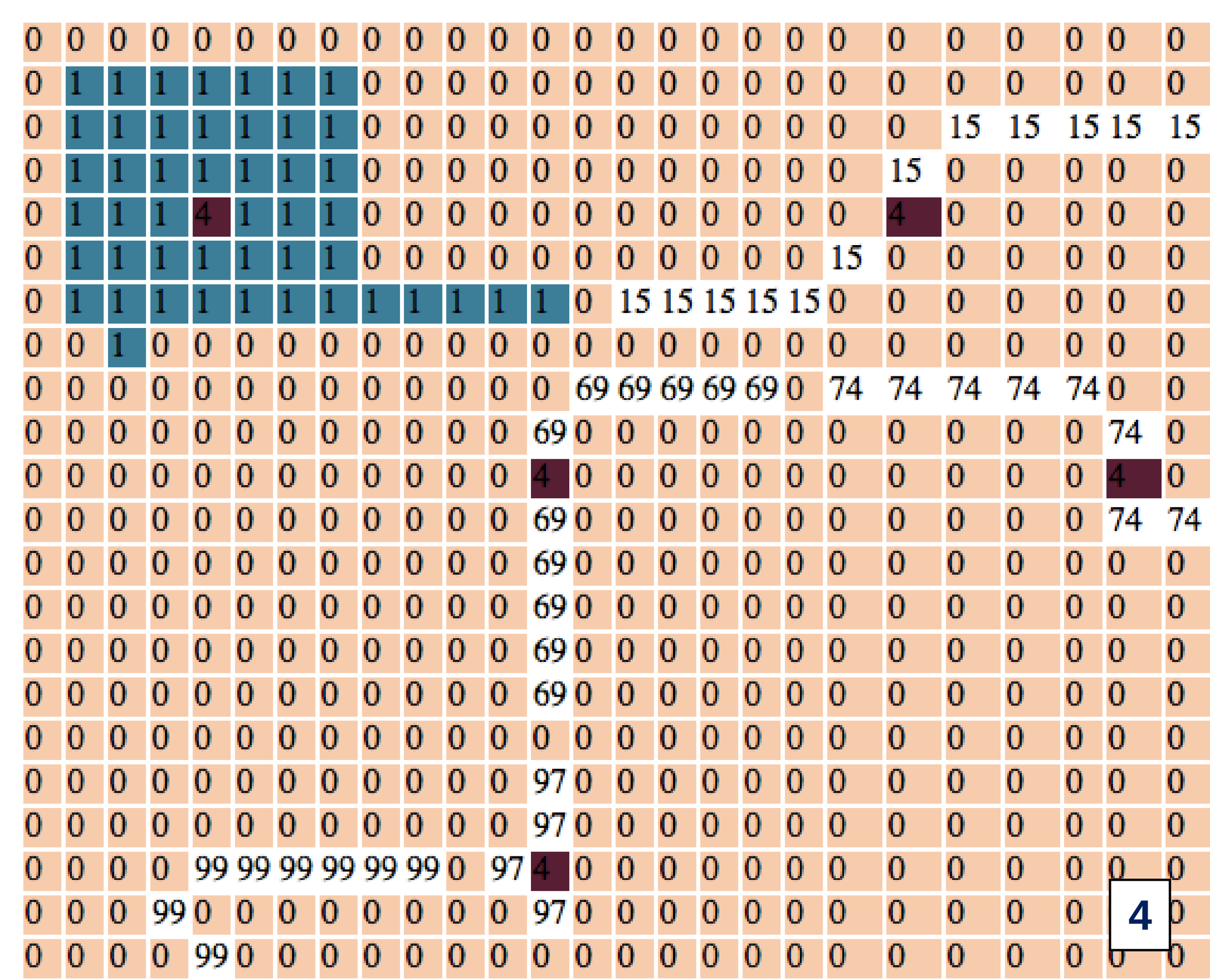
In this approach, the goal is to make a heuristic correlation between two anomalies in different frames and make a motion vector from the difference of their positions. Final correlation is achieved through the following steps:

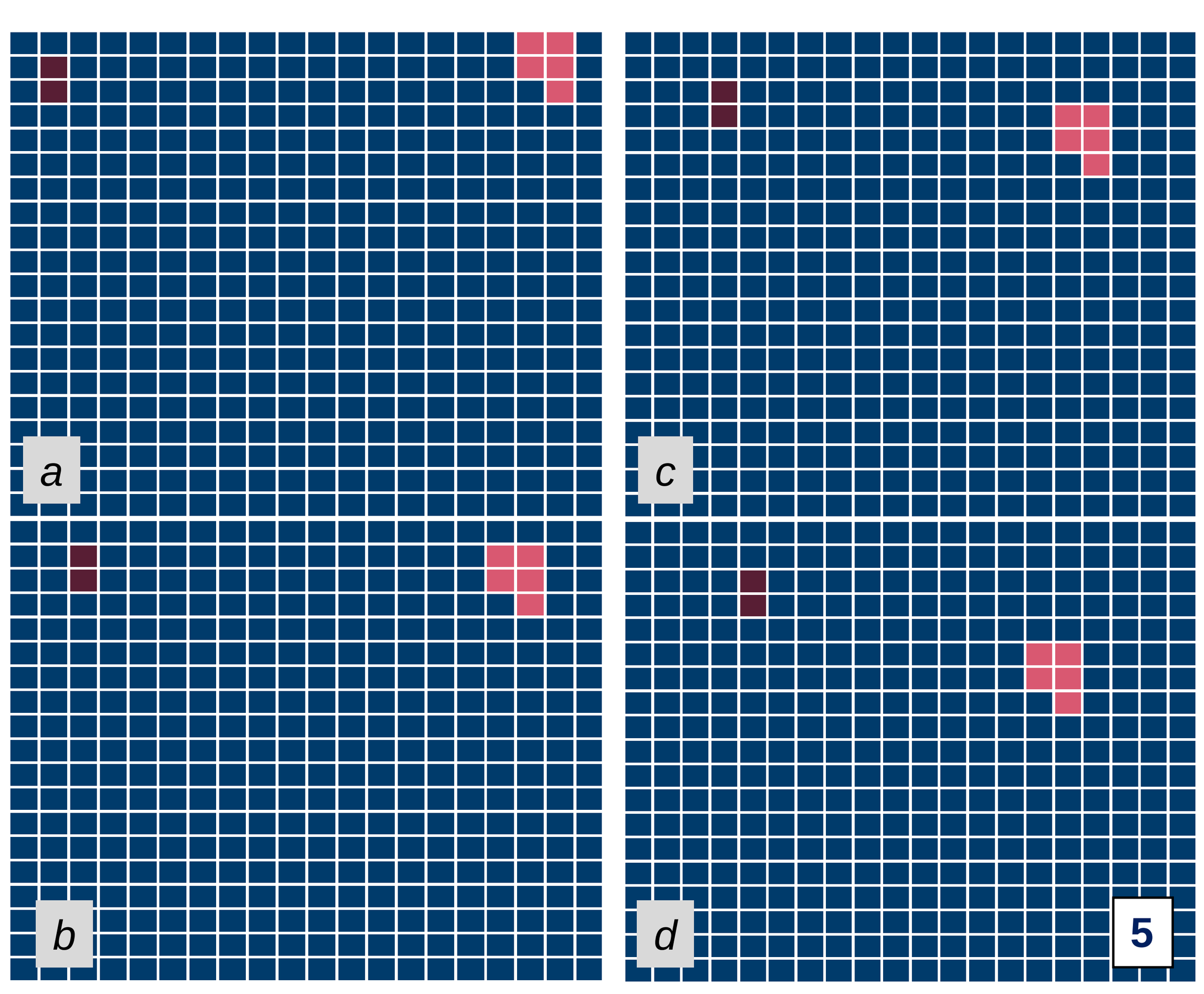
1) Create an array of temporal memory
2) Identify changes in every frame
3) Identify groups of changes (objects)
4) Identify center of every group
5) Correlate objects between groups
6) Create description of trajectories

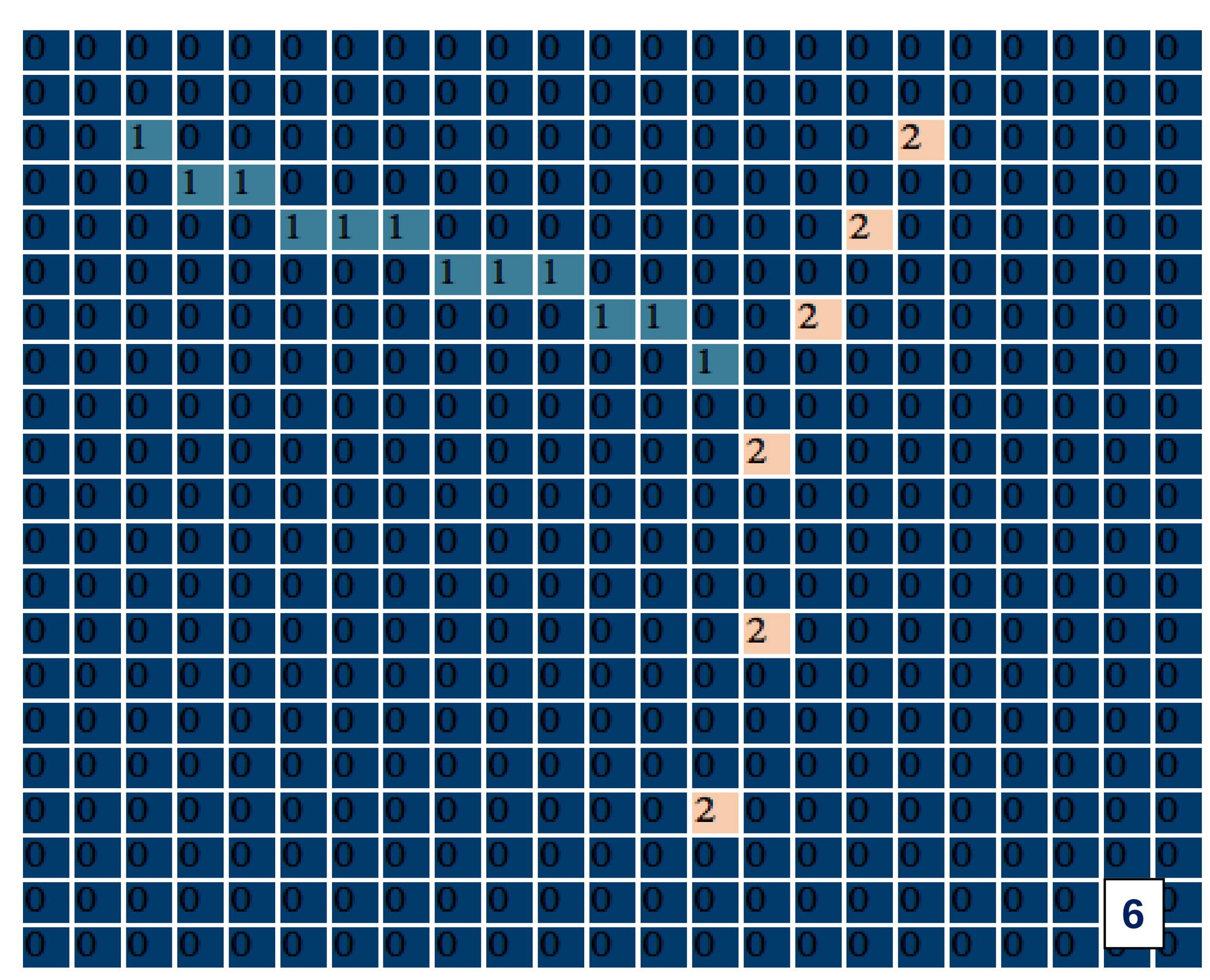
RESULTS: Tracking moving objects











Description of pixel arrays

1) Reference pixel array representing the average of six previous frames
2) Identification of an anomaly in the succeeding frame with relation to the reference array
3) Identification of *groups* of anomalies (close-up)
4) Finding the center of each group of anomalies
5) Sample successive frames showing motion
6) Output of the tracking algorithm, showing the path of the two moving objects in six frames

ANALISYS

The results show that multiple objects can be isolated and tracked in successive frames. As more information is gathered from the movement, predictions of the next position of an object becomes more accurate, which increases the chances and speed of correctly matching objects between any two frames.

CONCLUSIONS

- This algorithm utilizes correlation between anomalies in a frame compared to a reference average frame to detect objects. Correlation among objects in successive frames helps to track the objects in motion.
- Multiple objects can easily be tracked if the correlation between those objects in one frame and the same objects in a successive frame is sufficiently high and differentiable.

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