**ACTION**

**CODING**

**ENGINE (ACE)**

**Behavior Visualization**

**DATA ANALYTI CS**

🎓Batangas State University – The National Engineering University

This document summarizes all the processed data from the session “**{{Session\_Name}}”** that was analyzed with “**ACTION CODING ENGINE” (ACE)** last **{{Date\_Downloaded }}**. The data presented here is based on the findings and detections of the AI model developed and trained by our research group for the academic year 2024-2025.

Please note that this document does not contain any personal information of students, such as names, grades, or ages. It strictly presents **metrics and visualizations** of student behavior data as detected by the AI. This report is intended for research and analysis purposes only and **must not be used as the sole basis** for evaluating student performance or behavior. The AI system is a tool to assist in understanding behavioral patterns, but human judgment and contextual interpretation remain essential in any assessment.

**Document Details**

Date Downloaded : **{{Date\_Downloaded}}, {{Time\_Downloaded}}**

File Name: **{{File\_Name}}**

Session Name: **“{{Session\_Name}}”**

**PART 1:**

**AI**

**ANALYTICS**

**DATA**

*Powered by: UNO model*

This section uses an action recognition model or our “UNO model” to distinguish actions by the students. It detects and identifies the student’s whole body posture in determining the action. The key actions observed by this model are “Standing”, “Sitting”, “Extending Arms” for both left and right arms, “Facing Forward”, “Facing Sidewards” such as left and right.

Date & Time Processed*:* {{Date\_Downloaded}}, {{Time\_Downloaded}}

**Front Video Details:**

File Directory/Name

{{AI\_Front\_File\_Path}}

File Size

{{AI\_Front\_File\_Size}}

Video Length:

{{AI\_Front\_Video\_Length}}

**Center Video Details:**

File Directory/Name

{{AI\_Center\_File\_Path}}

File Size: {{AI\_Center\_File\_Size}}

Video Length: {{AI\_Center\_Video\_Length}}

**HEATMAP VISUALIZATIONS**

The following diagrams showcase heatmap visualizations generated at different time intervals—specifically at 25%, 50%, 75%, and 100% of the processed video footage. These heatmaps represent the frequency and spatial distribution of detected actions as the examination progresses, providing insight into how student behaviors evolve over time. Additionally, separate heatmaps highlight specific actions such as sitting, standing, and arm movements.

**Heatmap Graph Color Key:**

**Peru:** Sitting

**Dark Orange:** Right Arm Extending Sidewards

**Steel Blue:** Right Arm Neutral (Resting)

**Light Sea Green:** Right Arm Unknown

**Tomato Red:** Left Arm Extending Sidewards

**Forest Green:** Left Arm Neutral (Resting)

**Blue Violet:** Left Arm Unknown

**Dark Grey:** Standing

**Medium Orchid:** Facing Right

**Hot Pink:** Facing Left

**Dark Turquoise:** Facing Forward

**Bright Yellow:** Facing Downwards

{{Heatmap\_All\_Actions\_AI\_Analytics\_25}}

*Diagram 1.1 25% Heatmap for All Actions*

Diagram 1.1 displays the heatmap visualization of all detected actions within the first 25% of the video duration. The highlighted areas in the heatmap indicate zones with the highest concentration of movements or activities, offering an early glimpse into student behavior patterns.

{{Heatmap\_All\_Actions\_AI\_Analytics\_50}}

*Diagram 1.2 50% Heatmap for All Actions*

Diagram 1.2 presents the heatmap visualization of all detected actions up to 50% of the video duration. The data in the heatmap reflects the evolving distribution of activity, highlighting any noticeable shifts or increases in student movements as the examination progresses.

{{Heatmap\_All\_Actions\_AI\_Analytics\_75}}

*Diagram 1.3 75% Heatmap for All Actions*

Diagram 1.3 presents the heatmap visualization of all detected actions up to 75% of the video duration. The data in the heatmap shows how activity patterns continue to develop, potentially indicating increased movement or behavioral shifts nearing the later stages of the examination.

{{Heatmap\_All\_Actions\_AI\_Analytics\_100}}

*Diagram 1.4 100% Heatmap for All Actions*

Diagram 1.4 displays the complete heatmap of all detected actions throughout the entire video duration. The visualization in the heatmap offers a comprehensive overview of all student movements, revealing the most frequently active areas within the classroom during the full exam period.

**LINE GRAPH VISUALIZATIONS**

{{LineGraph\_All\_Actions\_AI}}  
*Diagram 2.1 Line Graph for All Actions*

Diagram 2.1 presents the line graph showing the trend of all detected actions throughout the video duration. The data in the graph provides insights into how student movements evolve over time.

{{LineGraph\_Sitting\_Actions\_AI}}  
*Diagram 2.2 Line Graph for Sitting Actions Only*

Diagram 2.2 shows the line graph for sitting actions only. This visualizes how often and consistently students remain seated during the examination.

{{LineGraph\_ExtendingRight\_Actions\_AI}}  
*Diagram 2.3 Line Graph for Extending Right Arm Actions Only*

Diagram 2.3 displays the line graph for right arm extension actions. It highlights moments when students extended their right arm, possibly indicating writing or reaching movements.

{{LineGraph\_ExtendingLeft\_Actions\_AI}}  
*Diagram 2.6 Line Graph for Extending Left Arm Actions Only*

Diagram 2.6 shows the temporal distribution of left arm extension actions. This can be indicative of note-taking, reaching, or signaling behavior.

{{LineGraph\_Standing\_Actions\_AI}}  
*Diagram 2.9 Line Graph for Standing Actions Only*

Diagram 2.9 presents the number of standing actions recorded during the exam. Peaks in the graph may indicate restroom breaks, submission events, or unusual movement.

{{LineGraph\_Facing\_Right\_AI}}  
*Diagram 2.10 Line Graph for Facing Right Only*

Diagram 2.10 shows the frequency of students facing to the right. These directional head movements may hint at distractions or communication attempts.

{{LineGraph\_Facing\_Left\_AI}}  
*Diagram 2.11 Line Graph for Facing Left Only*

Diagram 2.11 illustrates leftward head orientation patterns over time. It captures how often students looked to their left, potentially reflecting engagement or off-task behavior.

{{LineGraph\_Facing\_Forward\_AI}}  
*Diagram 2.12 Line Graph for Facing Forward Only*

Diagram 2.12 provides a view of how often students were facing forward. A high consistency in this action may correlate with focus on the examination.

{{LineGraph\_Facing\_Downward\_AI}}  
*Diagram 2.13 Line Graph for Facing Downward Only*

Diagram 2.13 reveals the instances where students faced downward. This could indicate reading, writing, or disengagement depending on context.

**Conclusion:**

The AI Analytics Data powered by the UNO model provides a comprehensive summary of student behaviors during an examination by analyzing video footage from both front and center camera angles. Key video details such as file names, sizes, creation dates, and durations are documented to ensure traceability. Heatmap visualizations and line graphs illustrate the frequency and distribution of specific actions—such as sitting, standing, arm movements, and head orientation—at various intervals (25%, 50%, 75%, and 100%) throughout the exam. Each action is color-coded to provide a clear, intuitive understanding of behavioral patterns. Heatmaps offer spatial insights by showing where actions most frequently occurred in the classroom, while line graphs depict how these behaviors evolved over time. Sitting remained the most consistent action, suggesting general compliance with examination protocols, while fluctuations in arm movements and head directions could indicate engagement, distraction, or potential misconduct. This data-driven approach enables educators to monitor and assess student behavior more efficiently, providing a reliable visual and statistical overview of classroom activity during examinations.

**PART 2:**

**ADVANCED**

**ANALYTICS DATA**

Date & Time Processed*:* {{Date\_Downloaded}}, {{Time\_Downloaded}}

File Directory/Name

{{AI\_Front\_File\_Path}}

File Size

{{AI\_Front\_File\_Size}}

Video Length:

{{AI\_Front\_Video\_Length}}

**Center Video Details:**

File Directory/Name

{{AI\_Center\_File\_Path}}

File Size: {{AI\_Center\_File\_Size}}

Video Length{{AI\_Center\_Video\_Length}}

#### **HEATMAP VISUALIZATIONS**

The following heatmaps show where and how often student actions were detected at different points in time specifically at 25%, 50%, 75%, and 100% of the video footage. These visualizations help track how student behavior changes as the exam goes on. Separate heatmaps are also included to show specific actions like sitting, standing, and moving arms.

**Heatmap Graph Color Key:**

**Peru:** Sitting

**Dark Orange:** Right Arm Extending Sidewards

**Steel Blue:** Right Arm Neutral (Resting)

**Light Sea Green:** Right Arm Unknown

**Tomato Red:** Left Arm Extending Sidewards

**Forest Green:** Left Arm Neutral (Resting)

**Blue Violet:** Left Arm Unknown

**Dark Grey:** Standing

**Medium Orchid:** Facing Right

**Hot Pink:** Facing Left

**Dark Turquoise:** Facing Forward

**Bright Yellow:** Facing Downwards

{{Heatmap\_All\_Actions\_Advanced\_Analytics\_25}}

*Diagram 1.3 25% Heatmap for All Actions*

Diagram 1.5 presents the heatmap visualization from the advanced analytics model, capturing all detected actions within the first 25% of the video duration. The data in the heatmap highlights the initial distribution of movements, helping identify early activity zones in the classroom.

{{Heatmap\_All\_Actions\_Advanced\_Analytics\_50}}

*Diagram 1.4 50% Heatmap for All Actions*

Diagram 1.6 shows the advanced analytics heatmap up to 50% of the video duration. The visualization in the heatmap reflects the mid-examination behavior patterns and potential changes in activity compared to the initial phase.

{{Heatmap\_All\_Actions\_Advanced\_Analytics\_75}}

*Diagram 1.5 75% Heatmap for All Actions*

Diagram 1.7 displays the advanced analytics heatmap at 75% of the video. The data in the heatmap helps visualize how student actions evolve as the exam approaches its final quarter, possibly indicating increased activity.

{{Heatmap\_All\_Actions\_Advanced\_Analytics\_100}}

*Diagram 1.6 100% Heatmap for All Actions*

Diagram 1.8 presents the complete heatmap using advanced analytics across 100% of the video duration. The visualization in the heatmap provides a full summary of student movements throughout the entire examination period.

#### **LINE GRAPH VISUALIZATIONS**

{{LineGraph\_All\_Actions\_Advanced}}  
*Diagram 2.1 Line Graph for All Actions*

Diagram 2.1 displays the line graph for all actions using advanced analytics. This graph shows the trend of student movements throughout the examination period, providing insights into the overall activity levels at each time point.

{{LineGraph\_ExtendingRight\_Actions\_Advanced}}  
*Diagram 2.3 Line Graph for Extending Right Arm Actions Only*

Diagram 2.3 shows the line graph for extending right arm actions only. The graph illustrates the occurrence of right arm movements over time, indicating how often students engaged in actions like reaching or writing.

{{LineGraph\_RightArmResting\_Actions\_Advanced}}  
*Diagram 2.4 Line Graph for Right Arm Neutral (Resting) Actions Only*

Diagram 2.4 displays the line graph for right arm neutral (resting) actions only. This line graph highlights the periods when students kept their right arm stationary or relaxed, offering insights into moments of inactivity.

{{LineGraph\_RightArmUnknown\_Actions\_Advanced}}  
*Diagram 2.5 Line Graph for Right Arm Unknown Actions Only*

Diagram 2.5 presents the line graph for right arm unknown actions only. The graph tracks moments when the model could not definitively categorize the movement of the right arm, suggesting uncertain or ambiguous actions.

{{LineGraph\_ExtendingLeft\_Actions\_Advanced}}  
*Diagram 2.6 Line Graph for Extending Left Arm Actions Only*

Diagram 2.6 displays the line graph for extending left arm actions only. The graph highlights when students extended their left arm, showing the frequency of movements like reaching or writing with the left hand.

{{LineGraph\_LeftArmResting\_Actions\_Advanced}}  
*Diagram 2.7 Line Graph for Left Arm Neutral (Resting) Actions Only*

Diagram 2.7 shows the line graph for left arm neutral (resting) actions only. This line graph visualizes when students rested their left arm, indicating periods of inactivity or stillness.

{{LineGraph\_LeftArmUnknown\_Actions\_Advanced}}  
*Diagram 2.8 Line Graph for Left Arm Unknown Actions Only*

Diagram 2.8 presents the line graph for left arm unknown actions only. The graph tracks when the model was unable to classify the left arm movement, providing insights into moments of uncertain behavior.

{{LineGraph\_Facing\_Right\_Advanced}}  
*Diagram 2.10 Line Graph for Facing Right Only*

Diagram 2.10 shows the line graph for facing right actions only. The graph tracks how often students were observed facing to the right, revealing shifts in their attention or body position during the exam.

{{LineGraph\_Facing\_Left\_Advanced}}  
*Diagram 2.11 Line Graph for Facing Left Only*

Diagram 2.11 presents the line graph for facing left actions only. This graph illustrates how often students faced left, indicating moments of attention shift or movement during the exam.

{{LineGraph\_Facing\_Forward\_Advanced}}  
*Diagram 2.12 Line Graph for Facing Forward Only*

Diagram 2.12 displays the line graph for facing forward actions only. The graph shows when students were facing forward, suggesting more neutral positions or moments of focused engagement.

{{LineGraph\_Facing\_Downward\_Advanced}}  
*Diagram 2.13 Line Graph for Facing Downward Only*

Diagram 2.13 shows the line graph for facing downward actions only. This line graph visualizes how often students faced downwards, indicating periods of engagement with materials like reading or writing.

**AI ANALYTICS EVENT LOGS SUMMARY**

**Interval:**

|  |  |  |  |
| --- | --- | --- | --- |
| # | Start Time | End Time | Action Summary |
| {% for chunk in AI\_Analytics\_Chunk\_Summary\_Log %} {{ loop.index }} | {{ chunk.time\_range }} | | {{ chunk.summary }} |
| {% endfor %} |  | |  |

**ADVANCED ANALYTICS EVENT LOGS SUMMARY**

|  |  |  |  |
| --- | --- | --- | --- |
| # | Start Time | End Time | Action Summary |
| {% for chunk in Advanced\_Analytics\_Chunk\_Summary\_Log %} {{ loop.index }} | {{ chunk.time\_range }} | | {{ chunk.summary }} |
| {% endfor %} |  | |  |

**Conclusion:**

Heatmap visualizations were created to assess spatial activity at various intervals (25%, 50%, 75%, and 100%) of the video duration. Diagram 1.3 through Diagram 1.6 show these heatmaps for all detected actions, revealing how behavior evolves as the exam progresses. Diagram 1.7 further consolidates all action data across the full video, while Diagrams 1.8 to 1.19 isolate specific behaviors such as sitting, standing, various arm movements, and head orientations. These visualizations help identify hotspots and zones of frequent activity or behavioral changes within the classroom.

Complementing the heatmaps, a series of line graphs provide a temporal view of student behaviors. Diagram 2.1 shows the trends for all actions combined, while Diagrams 2.2 to 2.6 detail patterns in specific movements like sitting and extending or resting arms. These graphs contribute to understanding the duration and timing of student engagement or inactivity, as well as identifying periods of ambiguous or unknown behaviors detected by the model.