Appendix J Extended work for the Unsafe Train Tracks Case Study

J.1 Stage 1 Extended Work

J.1.1 Predictive Thinking Pipeline 1: Appreciate the Complex of the Problem Complexity

Step 1.2) Generate a descriptive image that visualises the unsafe behaviour

Table J.1 Visual representation for confused police officers

SECoT Title	Unsafe problematic behaviours visualisation
Input	Police Officers were called to the scene and tried to capture the Drone but were unsuccessful.
General Systems Rules	**General rule A**: Unsafe behaviour is a type of Confusing Behaviour. Confusing behaviour of some situation A, in any complexity, is a behaviour that seems contradictory to what is meant to be manifested. **General rule B:** Confusing behaviours lead to undesirable emergent outcomes about some elements (of the observed complexity) with respect to some element B, whereby situation A falls within element B's sphere of concern for others.
Predictive Thinking Method	**Predictive question 1.2.1:** How does the confusing behaviour appear visually? **Guiding prompt 1.2.2:** Graphically visualise how you perceive the problem, confusing the whole scenario encompassing the problem aspect. You may use text-to-image generation tools such as Dall-E to generate an

	abstract, simplistic sketch representing how you imagine the situation. You may experiment with different prompts until you find an appropriate (detailed yet realistic) representation of the problem as you picture it. **Step completion criteria 1.2.3:** The step is considered complete when a single appropriate visual representation visualises how parties to the problem are within each other's sphere of concern and how the model depicts a situation within the architect's sphere of concern.
Output **Prediction**	**Architect assertion 1.2.4:** The architect asserts that the following depiction model captures the confusing behaviour faithfully: 

Step 1.3) Define the complex of the complexity field

Table J.2 Defining the complex of complexes in problematic train track zone scenarios

SECoT Title	The complex of complexes definition
Input	**Architect assertion 1.2.4:** The architect asserts that the following depiction model captures the confusing behaviour faithfully:

	
General Systems Rules	**General rule C:** Complexity is a field containing an organisational experience of a phenomenon concerning a general problem-solver (such as a Predictive Observer). It involves an operational environment of coexisting complexes and the complicated nature (or types) of their relationships and interactions (epistemic uncertainty) for a Predictive Observer to predict their past, present, and future states (managing aleatoric uncertainty or randomness).
Thinking Method	**Predictive question 1.3.1:** What is the Complex of coexisting elements involved in the problematic situation, as observed in the model? **Guiding prompt 1.3.2:** Guided by the visual representation, infer a complex of complexes you imagined to be part of your perceived scenario. **Step completion criteria 1.3.3:** The step is considered complete when a list of elements is defined and can be identified in the visualisation model.
Output Prediction	**Architect assertion 1.3.4:** The architect asserts that: The following list represents the complex of concerns: {train, multiple police officers, adversarial drone}

Step 1.4) Define the supra-complexes and their PrimePs

Table J.3 captures the observed systems we identified and the naming convention in terms of their Primary Capability.

Table J.3 The list of systems identified and their conventional representation in the AIC analysis

Observed System	Primary purpose (PrimeP)	Primary Capability (PrimeC)
Train	Transport passengers or goods along the designated train tracks.	{moving_train}
Adversarial Drone	Disrupt or gather intelligence within the train tracks zone by evading detection and obstacles.	{roaming_adversarial_drone}
Train tracks zone	Facilitate train bounded safe passage	{train_tracks zone_structure}
Train Tracks	Guide and stabilise the train, ensuring it follows a safe and designated path.	{train_tracks_structure}
Train tracks zone fence	Provide a clear distinction and boundary to separate the train's pathway from adjacent areas.	{train_tracks_zone_fence structure}
Vegetation Around the Fence	It grows naturally and provides environmental diversity around the train tracks zone.	{vegetation_structure}
Electric Powerlines	Supply electricity to the train for its operations and other connected infrastructure.	{powered_powerlines_cables_structure}
Police Force	Enforce law and order, ensuring safety and security within the train tracks zone.	{police_officer_situational_awareness}
Train driver	Operate the train safely along the designated route, maintaining awareness of the train's environment and any potential hazards.	{train_driver_situational_awareness}

Table J.3 provides a concise overview of each observed system in the domain, along with its primary purpose (PrimeP) and primary capability (PrimeC). Rather than simply labelling a factor by its generic name (e.g., “train”), each system is given a more precise situational descriptor—such as {moving_train}—to reflect how it functions or poses concerns within the environment. For example, the train is identified by its pur!pose of transporting passengers or goods along the designated tracks, and its PrimeC is captured as {moving_train}, emphasising motion and potential hazards. Similarly,

the adversarial drone aims to disrupt or gather intelligence, represented by {roaming_adversarial_drone} to stress its dynamic threat. This approach extends to other systems (like train tracks, fences, vegetation, electric powerlines, police force, and train driver), ensuring each one is associated with a clear functional label that anchors both its role (PrimeP) and its defining capability or situation (PrimeC). This practice improves clarity and consistency when referencing these systems throughout subsequent design or safety analyses.

J.1.2 Predictive Thinking Pipeline 2: Resolve the Complicatedness pattern of the observed complexity

Step 2.1) Problem Interaction Analysis Using Actions Matrix

Table J.4 Detailed Actions Matrix

	Train	**adversarial drone**	**train tracks**	**track zone fence**	**vegetation around fence**	**electric powerlines wires**	**Police Officer**
Train		approaches	drives over	maintaining path	moving and disturbing	pantograph connects to wires (sparks and wobble)	complicate
adversarial drone	approaches		recognises and follow	recognises and cross	recognises and avoids	recognises and avoids	distress
train tracks	guide and stabilise	guides roaming		adds visual complexity to track zone fence visual appearance with respect to intelligent perception	adds visual complexity to vegetation to track zone fence visual appearance with respect to intelligent perception	adds visual complexity to electrical powerline visual appearance with respect to intelligent perception	Permit access

track zone fence	providing a clear demarcation that separates the train's pathway from adjacent areas	provides a clear visual demarcation of train track zone and permits access	providing a clear demarcation that separates the train tracks from adjacent areas		adds visual complexity to vegetation to track zone fence visual appearance with respect to intelligent perception	adds visual complexity to electrical powerline visual appearance with respect to intelligent perception	support
vegetation around fence	obstruct train's passage	obstruct adversarial drone's fence recognition and provide shelter	fallen vegetation adds visual complexity to train tracks' visual appearance with respect to intelligent perception	adds visual complexity to fence visual recognisability with respect to intelligent perception		Fallen vegetation such as leaves and pollen, adds visual complexity to electrical powerlines recognisability with respect to intelligent perception	complicate
electric powerlines wires	supply electricity	obstructs adversarial drone flight around train track zone	add visual complexity to train tracks' visual appearance with respect to intelligent perception.	add visual complexity to train track fence visual appearance with respect	Electric powerlines add visual complexity to vegetation around the fence.		Complicate
Police Officer	Support	capture	monitor	monitor	Ignore	Monitor	

	Train	adversarial drone	train tracks	track zone fence	vegetation around fence	electric powerlines wires	Police Officer

Step 2.2) Predict the contributing factors (unsafe situations or opportunities)

Table J.5 Extended classification of unsafe and beneficial situations in train and adversarial drone interactions (sample of interactions)

Unsafe problematic situations	Beneficial or non-problematic situations
1. Train: 1.1. Unsafe approach of Train to an adversarial drone. Which may lead to a train crash. 1.4. Train instigates vegetation random motion around the fence. Which may impede any trained computer vision agent perception capability. 1.5. Connected train pantograph to electric powerlines (sparks and wobble). Which may impede the ability to perceive any trained computer vision agents. **2. Adversarial Drone:** 2.1. Unsafe intended adversarial drone approach train, which may lead to a train crash. 2.2. Adversarial drone follows train tracks, which may lead to a train crash. 2.3. Adversarial drone crosses the train track zone fence, which may lead to a train crash. 2.4. Adversarial drone avoids vegetation around the fence, which may lead to a train crash.	**1. Train:** 1.2. Maintained train travel over train tracks. 1.3. The train follows a path within the train tracks' zone fence boundary. **2. Adversarial Drone:** 2.5. Adversarial drone collides with vegetation around the fence. **3. Train Tracks:** 3.1. Train tracks guide and stabilise the train. **4. Train tracks zone Fence:** 4.1. The train tracks zone fence provides a clear demarcation that separates the train's pathway from adjacent areas.

2.6. Adversarial drone avoids electric powerlines, which may lead to a train crash. 2.7. Adversarial drone collides with electric powerlines, which may lead to a train crash. **3. Train Tracks:** 3.2. Train tracks guide roaming_adversarial_drones and facilitate adversarial drone collision with the train. 3.3. Train tracks add visual complexity to train track zone fence visual appearance concerning any trained computer vision agent perception. 3.4. Train tracks add visual complexity to vegetation around the fence, which may impede any trained computer vision agent perception capability. 3.5. Train tracks add visual complexity to the electrical powerline's visual appearance, which may impede any trained computer vision agent perception capability. **4. Train tracks zone Fence:** 4.2. Train tracks zone fence provides a clear visual demarcation of train tracks zone which permits access to adversarial drones. 4.4. The train tracks zone fence supports vegetation growth into complex shapes and sizes, which may impede any trained computer vision agent perception capability. 4.5. The train tracks zone fence adds visual complexity to electrical powerline visual appearance, which may impede any trained computer vision agent perception capability. **5. Vegetation Around Fence:** 5.1. Vegetation around the fence obstructs the train's passage. Overgrowth may obstruct train driver situational awareness.	4.3. Train tracks zone fence provides a clear demarcation that separates the train tracks from adjacent areas. **5. Vegetation Around Fence:** 5.2. Vegetation around the fence obstructs the adversarial drone's fence recognition. **6. Electric Powerlines:** 6.1. Electric powerlines supply electricity to the train. 6.2. Electric powerlines obstruct adversarial drone flights around the train tracks zone.

5.3. Fallen vegetation adds visual complexity to train tracks' visual appearance with respect to intelligent perception, which may impede any trained computer vision agent perception capability. 5.4. Vegetation around the fence adds visual complexity to the fence's visual recognizability, which may impede any trained computer vision agent perception capability. 5.5. Fallen vegetation, such as leaves and pollen, adds visual complexity to electrical powerlines' recognizability, which may impede any trained computer vision agent perception capability. **6. Electric Powerlines:** 6.3. Electric powerlines add visual complexity to train tracks' visual appearance, which may impede any trained computer vision agent perception capability. 6.4. Electric powerlines add visual complexity to train tracks fence visual appearance, which may impede any trained computer vision agent perception capability. 6.5. Electric powerlines add visual complexity to vegetation around the fence, which may impede any trained computer vision agent perception capability.	
1. Police officers 7.1 Police Officers are incapable of catching adversarial drones. 7.2 Police Officers avoid getting hit by train. **2. Adversarial Drone** 8.1 Adversarial drone avoids capture by police. 8.2 Adversarial drones fly over the train, making it hard for police to manage it.	

3. Train 9.1 Train presence causes an obstacle to police officers' attempts to capture adversarial drones. 9.2 The train allows the adversarial drone to hover on top of it, making it harder for police officers to reach drones.	

J.1.3 Predictive Thinking Pipeline 3: Predict the Emergence of AIC Complexity Field for Detailed Operational Scenario Articulation

Step 3.1) Model detailed AIC interactions scenarios for the problem domain

Step 1) Select the Unsafe and Beneficial behaviours

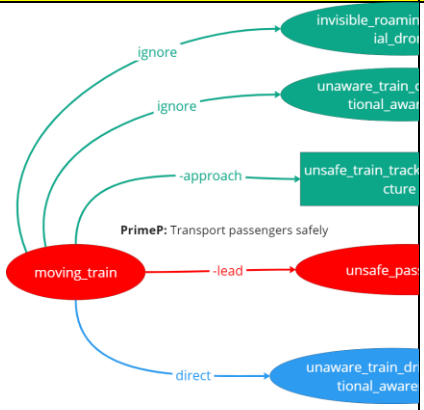
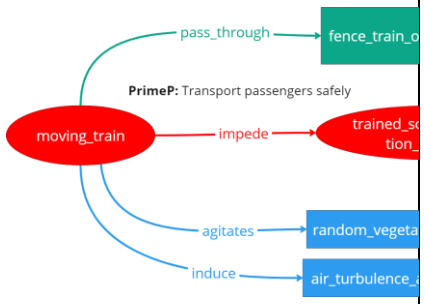
Step 2) Use AIC modelling schema to visualise the behaviour graphically.

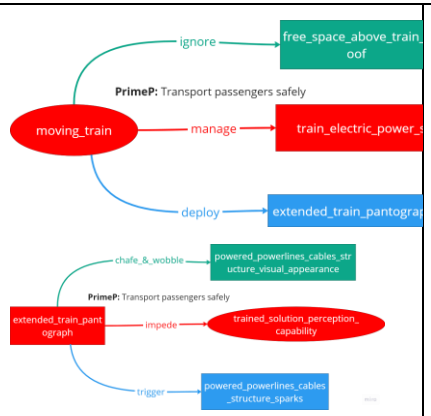
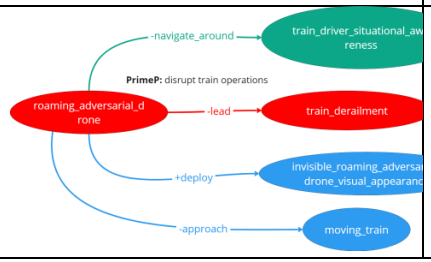
- Pick a source system.
- Identify the AIC interactions of the source system

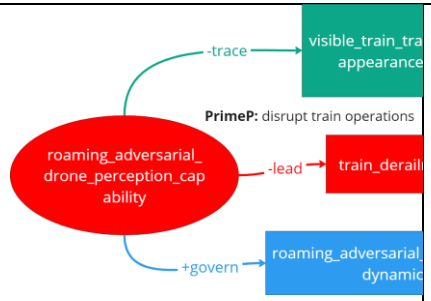
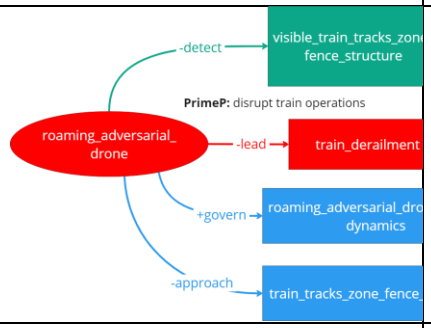
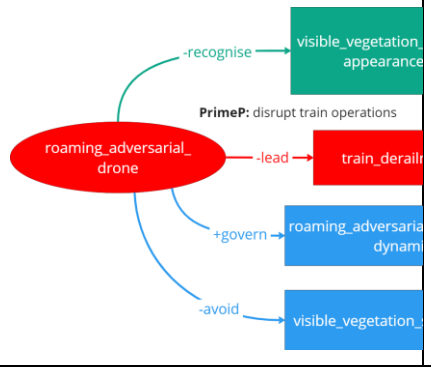
Step 3) What interactions are involved in making up for the unsafe behaviour? What assisted the behaviour? Write using the following format

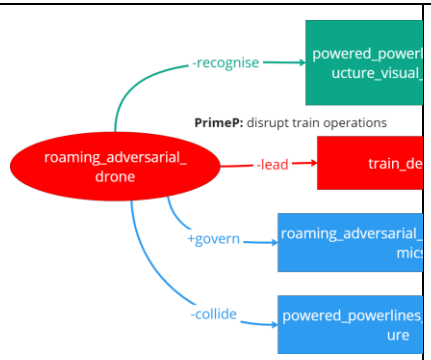
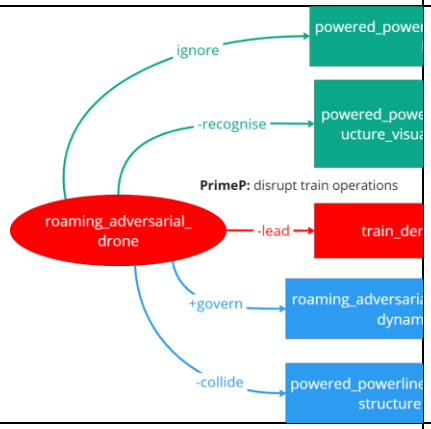
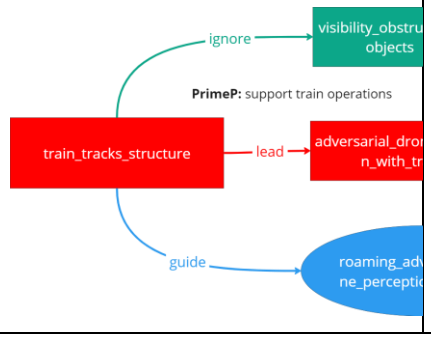
|{source aspect}_[action]_{sink aspect}|. Consider Appreciative and Control interactions, events or factors. Also, always find an adjective and a noun.

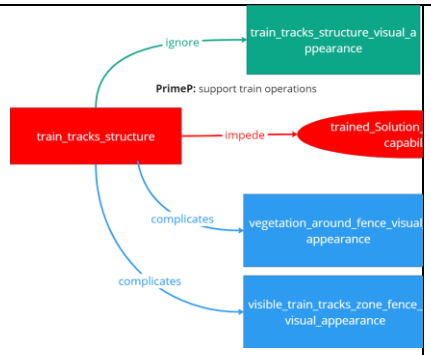
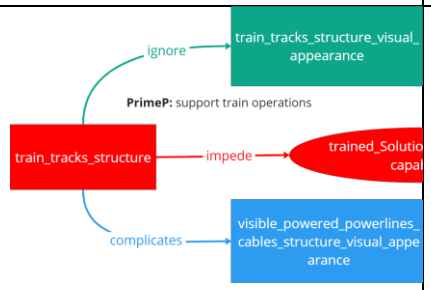
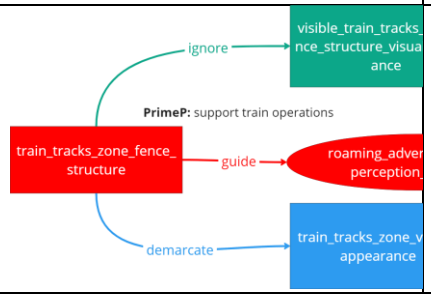
Table J.6 AIC problem domain scenarios definition

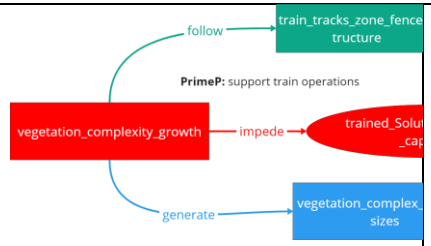
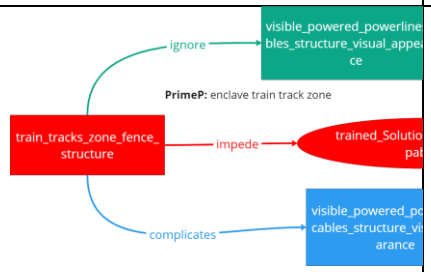
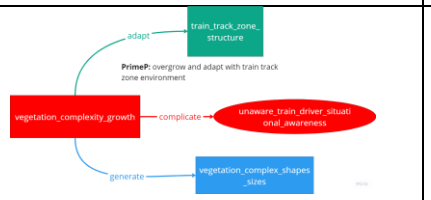
Step 1: Unsafe Interaction	**Step 2: AIC scenario model**	**Step 3: Formalised interactions for scenario definition**
1.1.Unsafe approach of train to an adversarial drone. Which may lead to a train crash.		**Unsafe_Scenario1.1 =** |{moving_train}_[approach]_{unsafe_train_tracks_zone_structure}|, |{moving_train}_[ignore]_{unaware_train_driver_situational_awareness}|, |{moving_train}_[ignore]_{roaming_adversarial_drone}|, |{moving_train}_[approach]_{unsafe_train_tracks_zone_structure}|, |{moving_train}_[lead]_{unsafe_unsecured_passengers_and_goods}|
1.4.Train instigates vegetation random motion around the fence. Which may impede the reliability of a any trained computer vision agent perception capability.		**Unsafe_Scenario1.4 =** |{moving_train}_[agitates]_{random_vegetation_motion}|, |{moving_train}_[induces]_{traveling_train_induced_air_turbulence_and_vibration}|, |{moving_train}_[pass_through]_{fence_to_train_open_space}|, |{moving_train}_[impede]_{any_trained_computer_vision_agent_perception_capability}|,

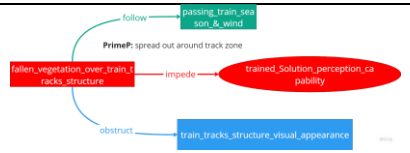
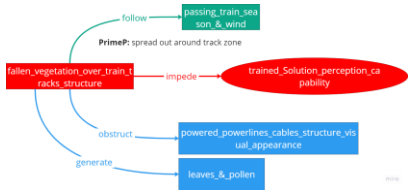
1.5.Connected train pantograph to electric powerlines (sparks and wobble). Which may impede the ability to perceive any trained computer vision agents.		**Unsafe_Scenario1.5 =** |{moving_train}_[manage]_{train_electric_power_supply}|, |{moving_train}_[deploy]_{extended_train_pantograph}|, |{moving_train}_[ignore]_{free_space_above_train_roof}|, |{extended_train_pantograph}_[impede]_{any_trained_computer_vision_agent_perception_capability}|, |{extended_train_pantograph}_[trigger]_{powered_powerlines_cables_structure_sparks}|, |{extended_train_pantograph}_[chafe_&_wobble]_{powered_powerlines_cables_structure_visual_appearance}|.
2.1. Unsafe intended adversarial drone approach train, which may lead to a train crash.		**Unsafe_Scenario2.1** |{roaming_adversarial_drone}_[+manage]_{invisible_roaming_adversarial_drone_visual_appearance}|, |{roaming_adversarial_drone}_[-lead]_{train_derailment}|, |{roaming_adversarial_drone}_[-navigate_around]_{train_driver_situational_awareness}| |{roaming_adversarial_drone}_[-approach]_{moving_train}|.

2.2.Adversarial drone follows train tracks, which may lead to a train crash.		**Unsafe_Scenario2.2** |{roaming_adversarial_drone_perception_capability}_[-trace]_{visible_train_tracks_appearance}|, |{roaming_adversarial_drone_perception_capability}_[-lead]_{train_derailment}|, |{roaming_adversarial_drone_perception_capability}_[+govern]_{roaming_adversarial_drone_flight_dynamics}|
2.3.Adversarial drone crosses the train track zone fence, which may lead to a train crash.		**Unsafe_Scenario2.3 (**Unsafe_Scenario2.2 |{roaming_adversarial_drone}_[-detect]_{visible_train_tracks_zone_fence_structure}|, |{roaming_adversarial_drone}_[-lead]_{train_derailment}|, |{roaming_adversarial_drone}_[+govern]_{roaming_adversarial_drone_flight_dynamics}|, |{roaming_adversarial_drone}_[-approach]_{train_tracks_zone_fence_structure}|.
2.4.Adversarial drone avoids vegetation around the fence, which may lead to a train crash.		**Unsafe_Scenario2.4** |{roaming_adversarial_drone}_[+govern]_{roaming_adversarial_drone_flight_dynamics}|, |{roaming_adversarial_drone}_[-recognise]_{visible_vegetation_visual_appearance}|, |{roaming_adversarial_drone}_[-lead]_{train_derailment}|, |{roaming_adversarial_drone}_[-avoid]_{visible_vegetation_structure}|

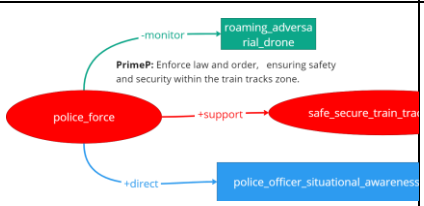
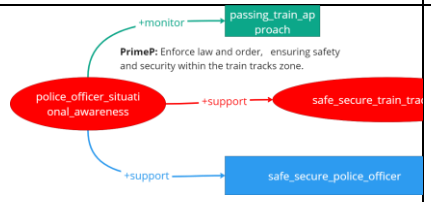
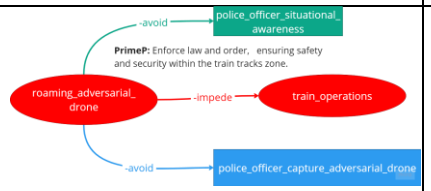
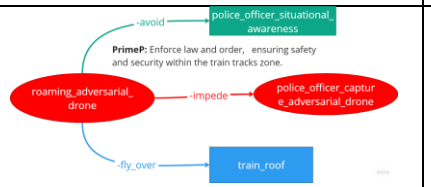
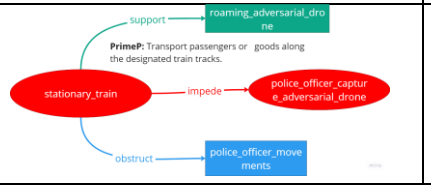
2.6.Adversarial drone avoids electric powerlines, which may lead to a train crash.		**Unsafe_Scenario2.6** |{roaming_adversarial_drone}_[-recognise]_{powered_powerlines_cables_structure_visual_appearance}|, |{roaming_adversarial_drone}_[-lead]_{train_derailment}|, |{roaming_adversarial_drone}_[-avoid]_{powered_powerlines_cables_structure_visual_appearance}|, |{roaming_adversarial_drone}_[+govern]_{roaming_adversarial_drone_flight_dynamics}|.
2.7.Adversarial drone collides with electric powerlines, which may lead to a train crash.		**Unsafe_Scenario2.7** |{roaming_adversarial_drone}_[ignore]_{powered_powerlines_cables_EMF}|, |{roaming_adversarial_drone}_[-recognise]_{powered_powerlines_cables_structure_visual_appearance}|, |{roaming_adversarial_drone}_[-collide]_{powered_powerlines_cables_structure}|, |{roaming_adversarial_drone}_[-lead]_{train_derailment}|, |{roaming_adversarial_drone}_[+govern]_{roaming_adversarial_drone_flight_dynamics}|.
3.2.Train tracks guide roaming_adversarial_drones, leading to the facilitation of adversarial drone collision with the train.		**Unsafe_Scenario3.2** |{train_tracks_structure}_[ignore]_{visibility_obstructive_objects}|, |{train_tracks_structure}_[lead]_{adversarial_drone_collision_with_train}|, |{train_tracks_structure}_[guide]_{roaming_adversarial_drone_perception_capability}|

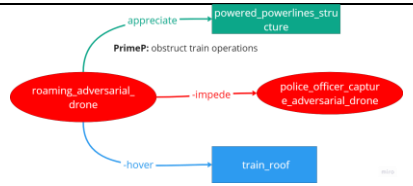
3.4.Train tracks add visual complexity to vegetation around the fence, which may impede any trained computer vision agent perception capability.		Unsafe_Scenario3.4 |{train_tracks_structure}_[ignore]_{train_tracks_structure_visual_appearance}|, |{train_tracks_structure}_[impede]_{any_trained_computer_vision_agent_perception_capability}|, |{train_tracks_structure}_[complicates]_{vegetation_complex_shapes_sizes_visual_appearance}|, |{train_tracks_structure}_[complicates]_{visible_train_tracks_zone_fence_structure_visual_appearance}|.
3.5.Train tracks add visual complexity to the electrical powerline's visual appearance recognition, which may impede any trained computer vision agent perception capability.		**Unsafe_Scenario3.5** |{train_tracks_structure}_[ignore]_{train_tracks_structure_visual_appearance}|, |{train_tracks_structure}_[impede]_{any_trained_computer_vision_agent_perception_capability}|, |{train_tracks_structure}_[complicates]_{visible_powered_powerlines_cables_structure_visual_appearance}|
4.2.Train tracks zone fence provides a clear visual demarcation of train tracks zone which permits access to adversarial drones.		**Unsafe_Scenario4.2** |{train_tracks_zone_fence_structure}_[ignore]_{visible_train_tracks_zone_fence_structure_visual_appearance}|, |{train_tracks_zone_fence_structure}_[guide]_{roaming_adversarial_drone_perception_capability}|, |{train_tracks_zone_fence_structure}_[demarcate]_{train_tracks_structure_visual_appearance}|

4.4.The train tracks zone fence supports vegetation growth into complex shapes and sizes, which may impede any trained computer vision agent perception capability.		**Unsafe_Scenario4.4** |{vegetation_complexity_growth}_[follow]_{train_tracks_zone_fence_structure}|, |{vegetation_complexity_growth}_[impede]_{any_trained_computer_vision_agent_perception_capability}|, |{vegetation_complexity_growth}_[generate]_{vegetation_complex_shapes_sizes_visual_appearance}|
4.5.The train tracks zone fence adds visual complexity to electrical powerline visual appearance recognition, which may impede any trained computer vision agent perception capability.		**Unsafe_Scenario4.5** |{train_tracks_zone_fence_structure}_[ignore]_{visible_powered_powerlines_cables_structure_visual_appearance}|, |{train_tracks_zone_fence_structure}_[impede]_{any_trained_computer_vision_agent_perception_capability}|, |{train_tracks_zone_fence_structure}_[complicates]_{visible_powered_powerlines_cables_structure_visual_appearance}|
5.1.Vegetation around the fence obstructs the train's passage. Overgrowth may obstruct train driver situational awareness.		**Unsafe_Scenario5.1** |{vegetation_complexity_growth}_[adapt]_{train_track_zone_structure}|, |{vegetation_complexity_growth}_[complicate]_{unaware_train_driver_situational_awareness}|, |{vegetation_complexity_growth}_[generate]_{vegetation_complex_shapes_sizes_visual_appearance}|

5.3.Fallen vegetation adds visual complexity to train tracks' visual appearance recognition with respect to intelligent perception, which may impede any trained computer vision agent perception capability.		**Unsafe_Scenario5.3** |{fallen_vegetation_over_train_tracks_structure}_[follow]_{passing_train_season_&_wind}|, |{fallen_vegetation_over_train_tracks_structure}_[impede]_{any_trained_computer_vision_agent_perception_capability}|, |{fallen_vegetation_over_train_tracks_structure}_[obstruct]_{train_tracks_structure_visual_appearance}|
5.4.Vegetation around the fence adds visual complexity to the fence's visual recognizability, which may impede any trained computer vision agent perception capability.	**Covered in 4.4**	**Covered in 4.4**
5.5.Fallen vegetation, such as leaves and pollen, adds visual complexity to electrical powerlines' recognizability,		**Unsafe_Scenario5.5** |{fallen_vegetation_over_train_tracks_structure}_[follow]_{passing_train_season_&_wind}|, |{fallen_vegetation_over_train_tracks_structure}_[impede]_{any_trained_computer_vision_agent_perception_capability}|, |{fallen_vegetation_over_train_tracks_structure}_[obstruct]_{powered_powerlines_cables_structure_visual_appearance}|,

which may impede any trained computer vision agent perception capability.		|{fallen_vegetation_over_train_tracks_structure}_[generate]_{leaves_&_pollen}|
6.3.Electric powerlines add visual complexity to train tracks' visual appearance, which may impede any trained computer vision agent perception capability.	**Covered in 3.5**	**Covered in 3.5**
6.4.Electric powerlines add visual complexity to train tracks fence visual appearance recognition, which may impede any trained computer vision agent perception capability.	**Covered in 4.5**	**Covered in 4.5**
6.5.Electric powerlines add visual complexity to vegetation around the fence, which may impede any trained computer	**Covered in 5.5**	**Covered in 5.5**

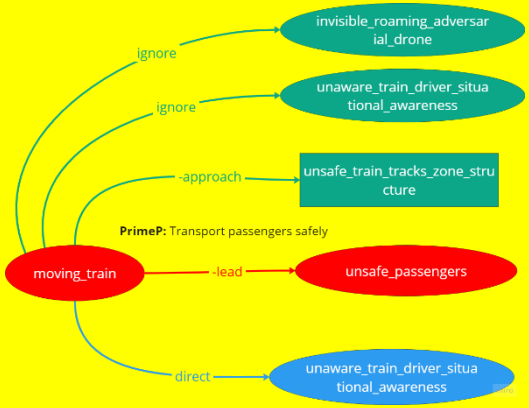
vision agent perception capability.		
7.1 Police Officers are incapable of catching adversarial drones.		Unsafe_Scenario7.1 |{police_force}_[-monitor]_{roaming_adversarial_drone}|, |{police_force}_[+support]_{safe_secure_train_track_zone}|, |{police_force}_[+direct]_{police_officer_situational_awareness}|
7.2 Police Officers avoid getting hit by train.		Unsafe_Scenario7.2 |{police_officer_situational_awareness}_[+monitor]_{passing_train_approach}|, |{police_officer_situational_awareness}_[+support]_{safe_secure_train_track_zone}|, |{police_officer_situational_awareness}_[+support]_{safe_secure_police_officer}|
8.1 Adversarial drone avoids capture by police.		**Unsafe_Scenario8.1** |{roaming_adversarial_drone}_[-avoid]_{police_officer_situational_awareness}|, |{roaming_adversarial_drone}_[-impede]_{all_trains_operations}|, |{roaming_adversarial_drone}_[-avoid]_{police_officer_capture_adversarial_drone}|
8.2 Adversarial drones fly over the train, making it hard for police to manage it.		**Unsafe_Scenario8.2** |{roaming_adversarial_drone}_[-avoid]_{police_officer_situational_awareness}|, |{roaming_adversarial_drone}_[-impede]_{police_officer_capture_adversarial_drone}|, |{roaming_adversarial_drone}_[-fly_over]_{free_space_above_train_roof}|
9.1 Train presence causes an obstacle to police officers' attempts to capture adversarial drones.		Unsafe_Scenario9.1 |{stationary_train}_[support]_{roaming_adversarial_drone}|, |{stationary_train}_[impede]_{police_officer_capture_adversarial_drone}|, |{stationary_train}_[obstruct]_{police_officer_movements}|

9.2 The train allows the adversarial drone to hover on top of it, making it harder for police officers to reach drones.		Unsafe_Scenario9.2 |{roaming_adversarial_drone}_[appreciate]_{powered_powerlines_cables_structure_visual_appearance}|, |{roaming_adversarial_drone}_[-impede]_{police_officer_capture_adversarial_drone}|, |{roaming_adversarial_drone}_[-hover]_{free_space_above_train_roof}|

Step 3.2) Predict the extended list of emergent AIC interactions scenarios

We then capture the interactions in the figure above using the following SECoT. Note we use the interaction format of |{situation}_[action]_{situation}| to help us with automating extraction of factors. The key activity is we would do the AIC factorisation to each interaction in order to reveal the hidden interactions.

Table J.7 AIC Extended Scenarios

step 1: unsafe problematic situations 	**unsafe_scenario1.1 =** |{moving_train}_[approach]_{unsafe_train_tracks_zone_structure}|, |{moving_train}_[direct]_{unaware_train_driver_situational_awareness}|, |{moving_train}_[ignore]_{roaming_adversarial_drone}|, |{moving_train}_[approach]_{unsafe_train_tracks_zone_structure}|, |{moving_train}_[lead]_{unsafe_unsecured_passengers_and_goods}|	
step 2: observed system (obs)	**step 3: observed action**	**step 4: supra source primary purpose**

moving_train	|{moving_train}_[approach]_{unsafe_train_tracks_zone_structure}|	primary purpose: transport passengers or goods along the designated train tracks.
step 5: auxiliary influence interaction	**step 6: auxiliary control interaction**	**step 7: auxiliary appreciation interaction**
influence goal: 1. |{moving_train}_[maintains]_{safe_passengers_and_goods}| 2. |{moving_train}_[maintains]_{safe_passengers_and_goods}| **influence actions:** 1. |{moving_train}_[inform]_{train_driver_situational_awareness}| 2. |{moving_train}_[prevent]_{unsafe_unsecured_passengers_and_goods}| 3. |{moving_train}_[prevent]_{unsafe_unsecured_passengers_and_goods}|	**control goals:** 1. |{moving_train}_[control]_{onboard_train_safety_systems}| 2. |{moving_train}_[control]_{alert_systems}| **control actions:** **for {onboard_train_safety_systems} (preventing unsafe passengers/goods):** 1. |{moving_train}_[activate]_{onboard_train_safety_systems}| **for {alert_systems} (informing the train driver):** 2. |{moving_train}_[trigger]_{alert_systems}| 3. |{moving_train}_[alert]_{train_driver_situational_awareness}|	**appreciation goal:** 1. |{moving_train}_[appreciate]_{track_zone_monitoring_systems}| **appreciative actions:** 1. |{moving_train}_[initiate_collection]_{track_zone_monitoring_systems_data}| 2. |{moving_train}_[acknowledge]_{timely_track_zone_monitoring_systems_data}| 3. |{moving_train}_[acknowledge]_{accurate_track_zone_monitoring_systems_data}| 4. |{moving_train}_[highlight]_{track_zone_monitoring_sy

		stems_data_gaps_or_inco nsistencies}|

step 8: predicted problem domain factors or features (with repetition)		
factors or features that manifest influence interaction: ['moving_train', 'safe_passengers_and_goods', 'moving_train', 'safe_passengers_and_goods', 'moving_train', 'train_driver_situational_awareness', 'moving_train', 'unsafe_unsecured_passengers_and_goods', 'moving_train', 'unsafe_unsecured_passengers_and_goods'] **factors or features that manifest control interaction:** ['moving_train', 'onboard_train_safety_systems', 'moving_train', 'alert_systems', 'onboard_train_safety_systems', 'moving_train', 'onboard_train_safety_systems', 'alert_systems', 'moving_train', 'alert_systems', 'moving_train', 'train_driver_situational_awareness'] **factors or features that manifest appreciation interaction:** ['moving_train', 'track_zone_monitoring_systems', 'moving_train', 'track_zone_monitoring_systems_data', 'moving_train', 'timely_track_zone_monitoring_systems_data', 'moving_train', 'accurate_track_zone_monitoring_systems_data', 'moving_train', 'track_zone_monitoring_systems_data_gaps_or_inconsistencies']		

step 2: observed system (obs)	**step 3: observed action**	**step 4: supra source primary purpose**
moving_train	|{moving_train}_[approach]_{roaming_adversarial_dron e}|	primary purpose: transport passengers or goods along the designated train tracks.
step 5: auxiliary influence interaction	**step 6: auxiliary control interaction**	**step 7: auxiliary appreciation interaction**

influence goal: |{moving_train}_[influence]_{roaming_adversarial_drones}| **influence actions:** 1. communication (ground-based security systems): 1.1 |{moving_train}_[inform]_{available_ground_based_security_systems}| 1.2 |{moving_train}_[communicate]_{roaming_adversarial_drones_location_data}| 1.3 |{moving_train}_[communicate]_{roaming_adversarial_drones_information}| 2. coordination (emergency response teams): 2.1 |{moving_train}_[trigger_communication]_{unaware_emergency_response_teams}|	**control goal 1:** 1. |{moving_train}_[control]_{available_ground_based_security_systems}| 2. |{moving_train}_[control]_{roaming_adversarial_drones_location_data}| 3. |{moving_train}_[control]_{roaming_adversarial_drones_information}| **control actions 1:** **for communication interface:** 1. |{moving_train}_[establish_connection]_{available_ground_based_security_systems}| 2. |{moving_train}_[transmit_data_packets]_{onboard_train_communication_interface}| **for data processing unit:** 3. |{moving_train}_[filter]_{roaming_adversarial_drones_size_data}| 4. |{moving_train}_[filter]_{roaming_adversarial_drones_location_data}| 5. |{moving_train}_[filter]_{roaming_adversarial_drones_flying_behaviour_data}| 6. |{moving_train}_[prioritize]_{roaming_adversarial_drones_critical_data}| 7.	1. |{moving_train}_[appreciate]_{available_ground_based_security_systems}| 2. |{moving_train}_[appreciate]_{reliable_railways_communication_network}| 3. |{moving_train}_[appreciate]_{accurate_track_zone_monitoring_systems}| **appreciative actions:** 4. |{moving_train}_[monitor]_{available_ground_based_security_systems}| 5. |{moving_train}_[monitor]_{communication_network_connectivity}| 6. |{moving_train}_[establish]_{alternative_communication_channels}| 7. |{moving_train}_[verify]_{track_zone_monitoring_systems_data_plausibility}| 8. |{moving_train}_[confirms]_{ground_based_security_systems_received_data}| 9. |{moving_train}_[assess]_{disruptiv

	|{moving_train}_[format]_{roaming_adversarial_drones_information_transmitted_data}| **control goal 2:** 4. |{moving_train}_[trigger_communication]_{unaware_emergency_response_teams}| **control actions 2:** **for communication interface:** 5. |{moving_train}_[establish_connection]_{designated_emergency_response_communication_system}| 6. |{moving_train}_[transmit]_{onboard_train_communication_interface}{emergency_notification}|	e_adversarial_drones_threat_severity}|

step 8: predicted problem domain factors or features (with repetition)

factors or features that manifest influence interaction:

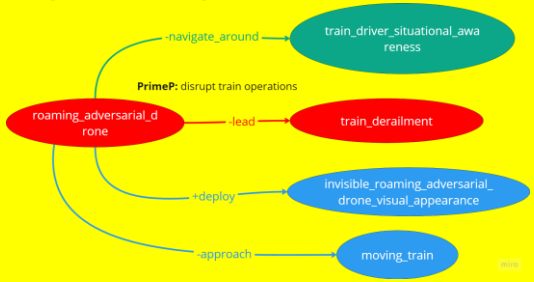
['moving_train', 'roaming_adversarial_drones', 'moving_train', 'available_ground_based_security_systems', 'moving_train', 'roaming_adversarial_drones_location_data', 'moving_train', 'roaming_adversarial_drones_information', 'moving_train', 'unaware_emergency_response_teams']

factors or features that manifest control interaction:

['moving_train', 'available_ground_based_security_systems', 'moving_train', 'roaming_adversarial_drones_location_data', 'moving_train', 'roaming_adversarial_drones_information', 'moving_train', 'available_ground_based_security_systems', 'moving_train', 'onboard_train_communication_interface', 'moving_train', 'roaming_adversarial_drones_size_data', 'moving_train', 'roaming_adversarial_drones_location_data', 'moving_train', 'roaming_adversarial_drones_flying_behaviour_data', 'moving_train',

<table>
<tr><td colspan="3">'roaming_adversarial_drones_critical_data', 'moving_train', 'roaming_adversarial_drones_information_transmitted_data', 'moving_train', 'unaware_emergency_response_teams', 'moving_train', 'designated_emergency_response_communication_system', 'moving_train', 'onboard_train_communication_interface', 'emergency_notification']

factors or features that manifest appreciation interaction:

['moving_train', 'available_ground_based_security_systems', 'moving_train', 'reliable_railways_communication_network', 'moving_train', 'accurate_track_zone_monitoring_systems', 'moving_train', 'available_ground_based_security_systems', 'moving_train', 'communication_network_connectivity', 'moving_train', 'alternative_communication_channels', 'moving_train', 'track_zone_monitoring_systems_data_plausibility', 'moving_train', 'ground_based_security_systems_received_data', 'moving_train', 'disruptive_adversarial_drones_threat_severity']</td></tr>
<tr><td>step 1: unsafe problematic situations
 
</td><td colspan="2">unsafe_scenario2.1
|{roaming_adversarial_drone}_[+manage]_{invisible_roaming_adversarial_drone_visual_appearance}|,

|{roaming_adversarial_drone}_[-lead]_{train_derailment}|,

|{roaming_adversarial_drone}_[-navigate_around]_{train_driver_situational_awareness}|,

|{roaming_adversarial_drone}_[-approach]_{moving_train}|,</td></tr>
<tr><td>Step 2: observed system (obs)</td><td>Step 3: observed action</td><td>step 4: supra source primary purpose</td></tr>
<tr><td>roaming_adversarial_drone</td><td>|{roaming_adversarial_drone}_[-approach]_{moving_train}|</td><td>primary purpose: disrupt or gather intelligence within the train tracks zone by evading detection and obstacles.</td></tr>
</table>

Step 5: auxiliary influence interaction	**Step 6: auxiliary control interaction**	**step 7: auxiliary appreciation interaction**
influence goals: 1. |{roaming_adversarial_drone}_[influence]_{train_driver_situational_awareness}| 2. |{roaming_adversarial_drone}_[influence]_{onboard_train_safety_systems}| **influence actions:** 3. |{roaming_adversarial_drone}_[maintain]_{low_altitude_roaming_adversarial_drone}| 4. |{roaming_adversarial_drone}_[employ]_{roaming_adversarial_drone_camouflage}| 5. |{roaming_adversarial_drone}_[suppress]_{roaming_adversarial_drone_noise_emissions}| 6. |{roaming_adversarial_drone}_[exploit]_{moving_train_blind_spots}|	**control goals:** 1. |{roaming_adversarial_drone}_[control]_{altitude_control_systems}| 2. |{roaming_adversarial_drone}_[control]_{camouflage_mechanisms}| 3. |{roaming_adversarial_drone}_[control]_{roaming_adversarial_drone_noise_suppression_systems}| 4. |{roaming_adversarial_drone}_[control]_{roaming_adversarial_drone_navigation_systems}| **control actions:** 1. |{roaming_adversarial_drone}_[adjust]_{altitude_parameters}| 2. |{roaming_adversarial_drone}_[activate]_{camouflage_mechanisms}| 3. |{roaming_adversarial_drone}_[reduce]_{roaming_adversarial_drone_noise_output}| 4. |{roaming_adversarial_drone}_[optimize]_{path_planning_algorithms}|	appreciation goals: 1. |{roaming_adversarial_drone}_[appreciate]_{weather_conditions}| 2. |{roaming_adversarial_drone}_[appreciate]_{train_schedule_timing}| 3. |{roaming_adversarial_drone}_[appreciate]_{train_tracks_maintenance_activities}| 4. |{roaming_adversarial_drone}_[appreciate]_{track_zone_obstacles}| **appreciative actions:** 1. |{roaming_adversarial_drone}_[monitor]_{weather_conditions}| 2. |{roaming_adversarial_drone}_[synchronize]_{train_schedule_timing}| 3. |{roaming_adversarial_drone}_[scan]_{train_tracks_ma

	5. |{roaming_adversarial_drone}_[monitor]_{weather_conditions}| 6. |{roaming_adversarial_drone}_[adapt]_{adversarial_drone_response_strategies}|	intenance_activities}| 4. |{roaming_adversarial_drone}_[detect]_{track_zone_obstacles}| 5. |{roaming_adversarial_drone}_[adapt]_{flight_path_based_on_weather}| 6. |{roaming_adversarial_drone}_[plan]_{routes_around_maintenance_activities}| 7. |{roaming_adversarial_drone}_[navigate]_{adversarial_drone_dangerous_navigation_around_obstacles}|

step 8: predicted problem domain factors or features (with repetition)

factors or features that manifest influence interaction:

['roaming_adversarial_drone', 'train_driver_situational_awareness', 'roaming_adversarial_drone', 'onboard_train_safety_systems', 'roaming_adversarial_drone', 'low_altitude_roaming_adversarial_drone', 'roaming_adversarial_drone', 'roaming_adversarial_drone_camouflage', 'roaming_adversarial_drone', 'roaming_adversarial_drone_noise_emissions', 'roaming_adversarial_drone', 'moving_train_blind_spots']

factors or features that manifest control interaction:

['roaming_adversarial_drone', 'altitude_control_systems', 'roaming_adversarial_drone', 'camouflage_mechanisms', 'roaming_adversarial_drone', 'roaming_adversarial_drone_noise_suppression_systems', 'roaming_adversarial_drone', 'roaming_adversarial_drone_navigation_systems', 'roaming_adversarial_drone', 'altitude_parameters', 'roaming_adversarial_drone', 'camouflage_mechanisms', 'roaming_adversarial_drone', 'roaming_adversarial_drone_noise_output', 'roaming_adversarial_drone', 'path_planning_algorithms', 'roaming_adversarial_drone', 'weather_conditions', 'roaming_adversarial_drone', 'adversarial_drone_response_strategies']

factors or features that manifest appreciation interaction:

['roaming_adversarial_drone', 'weather_conditions', 'roaming_adversarial_drone', 'train_schedule_timing', 'roaming_adversarial_drone', 'train_tracks_maintenance_activities', 'roaming_adversarial_drone', 'track_zone_obstacles', 'roaming_adversarial_drone', 'weather_conditions', 'roaming_adversarial_drone', 'train_schedule_timing', 'roaming_adversarial_drone', 'train_tracks_maintenance_activities', 'roaming_adversarial_drone', 'track_zone_obstacles', 'roaming_adversarial_drone', 'flight_path_based_on_weather', 'roaming_adversarial_drone', 'routes_around_maintenance_activities', 'roaming_adversarial_drone', 'adversarial_drone_dangerous_navigation_around_obstacles']

For simplicity, we will stop the AIC analysis here, and we focus on the high-level unsafe problematic interactions:

unsafe_scenario1.4 =|{moving_train}_[agitates]_{random_vegetation_motion}|,

|{moving_train}_[induces]_{traveling_train_induced_air_turbulence_and_vibration}|,

|{moving_train}_[pass_through]_{fence_to_train_open_space}|,

|{moving_train}_[impede]_{any_trained_computer_vision_agent_perception_capability}|,

unsafe_scenario1.5 =|{moving_train}_[manage]_{train_electric_power_supply}|,

|{moving_train}_[deploy]_{extended_train_pantograph}|,

|{moving_train}_[ignore]_{free_space_above_train_roof}|,

|{extended_train_pantograph}_[impede]_{any_trained_computer_vision_agent_perception_capability}|,

|{extended_train_pantograph}_[trigger]_{powered_powerlines_cables_structure_sparks}|,

|{extended_train_pantograph}_[chafe_&_wobble]_{powered_powerlines_cables_structure_visual_appearance}|

.unsafe_scenario2.1

|{roaming_adversarial_drone}_[+manage]_{invisible_roaming_adversarial_drone_visual_appearance}|,

|{roaming_adversarial_drone}_[-lead]_{train_derailment}|,

|{roaming_adversarial_drone}_[-navigate_around]_{train_driver_situational_awareness}|

.unsafe_scenario2.2

|{roaming_adversarial_drone_perception_capability}_[-trace]_{visible_train_tracks_appearance}|,

|{roaming_adversarial_drone_perception_capability}_[-lead]_{train_derailment}|,

|{roaming_adversarial_drone_perception_capability}_[+govern]_{roaming_adversarial_drone_flight_dynamics}|

unsafe_scenario2.3

(unsafe_scenario2.2

|{roaming_adversarial_drone}_[-detect]_{visible_train_tracks_zone_fence_structure}|,

|{roaming_adversarial_drone}_[-lead]_{train_derailment}|,

|{roaming_adversarial_drone}_[+govern]_{roaming_adversarial_drone_flight_dynamics}|,

|{roaming_adversarial_drone}_[-approach]_{train_tracks_zone_fence_structure}|

.unsafe_scenario2.4

|{roaming_adversarial_drone}_[+govern]_{roaming_adversarial_drone_flight_dynamics}|,

|{roaming_adversarial_drone}_[-recognise]_{visible_vegetation_visual_appearance}|,

|{roaming_adversarial_drone}_[-lead]_{train_derailment}|,

|{roaming_adversarial_drone}_[-avoid]_{visible_vegetation_structure}|

unsafe_scenario2.6

|{roaming_adversarial_drone}_[-recognise]_{powered_powerlines_cables_structure_visual_appearance}|,

|{roaming_adversarial_drone}_[-lead]_{train_derailment}|,

|{roaming_adversarial_drone}_[-avoid]_{powered_powerlines_cables_structure_visual_appearance}|,

|{roaming_adversarial_drone}_[+govern]_{roaming_adversarial_drone_flight_dynamics}|

.unsafe_scenario2.7

|{roaming_adversarial_drone}_[ignore]_{powered_powerlines_cables_emf}|,

|{roaming_adversarial_drone}_[-recognise]_{powered_powerlines_cables_structure_visual_appearance}|,

|{roaming_adversarial_drone}_[-collide]_{powered_powerlines_cables_structure}|,

|{roaming_adversarial_drone}_[-lead]_{train_derailment}|,

|{roaming_adversarial_drone}_[+govern]_{roaming_adversarial_drone_flight_dynamics}|

.unsafe_scenario3.2

|{train_tracks_structure}_[ignore]_{visibility_obstructive_objects}|,

|{train_tracks_structure}_[lead]_{adversarial_drone_collision_with_train}|,

|{train_tracks_structure}_[guide]_{roaming_adversarial_drone_perception_capability}|

unsafe_scenario3.4

|{train_tracks_structure}_[ignore]_{train_tracks_structure_visual_appearance}|,

|{train_tracks_structure}_[impede]_{any_trained_computer_vision_agent_perception_capability}|,

|{train_tracks_structure}_[complicates]_{vegetation_complex_shapes_sizes_visual_appearance}|,

|{train_tracks_structure}_[complicates]_{visible_train_tracks_zone_fence_structure_visual_appearance}|

.unsafe_scenario3.5

|{train_tracks_structure}_[ignore]_{train_tracks_structure_visual_appearance}|,

|{train_tracks_structure}_[impede]_{any_trained_computer_vision_agent_perception_capability}|,

|{train_tracks_structure}_[complicates]_{visible_powered_powerlines_cables_structure_visual_appearance}|

unsafe_scenario4.2

|{train_tracks_zone_fence_structure}_[ignore]_{visible_train_tracks_zone_fence_structure_visual_appearance}|,

|{train_tracks_zone_fence_structure}_[guide]_{roaming_adversarial_drone_perception_capability}|,

|{train_tracks_zone_fence_structure}_[demarcate]_{train_tracks_structure_visual_appearance}|

unsafe_scenario4.4

|{vegetation_complexity_growth}_[follow]_{train_tracks_zone_fence_structure}|,

|{vegetation_complexity_growth}_[impede]_{any_trained_computer_vision_agent_perception_capability}|,

|{vegetation_complexity_growth}_[generate]_{vegetation_complex_shapes_sizes_visual_appearance}|

unsafe_scenario4.5

|{train_tracks_zone_fence_structure}_[ignore]_{visible_powered_powerlines_cables_structure_visual_appearance}|,

|{train_tracks_zone_fence_structure}_[impede]_{any_trained_computer_vision_agent_perception_capability}|,

|{train_tracks_zone_fence_structure}_[complicates]_{visible_powered_powerlines_cables_structure_visual_appearance}|

unsafe_scenario5.1

|{vegetation_complexity_growth}_[adapt]_{train_track_zone_structure}|,

|{vegetation_complexity_growth}_[complicate]_{unaware_train_driver_situational_awareness}|,

|{vegetation_complexity_growth}_[generate]_{vegetation_complex_shapes_sizes_visual_appearance}|

unsafe_scenario5.3

|{fallen_vegetation_over_train_tracks_structure}_[follow]_{passing_train_season_&_wind}|,

|{fallen_vegetation_over_train_tracks_structure}_[impede]_{any_trained_computer_vision_agent_perception_capability}|,

|{fallen_vegetation_over_train_tracks_structure}_[obstruct]_{train_tracks_structure_visual_appearance}|covered in 4.4

unsafe_scenario5.5

|{fallen_vegetation_over_train_tracks_structure}_[follow]_{passing_train_season_&_wind}|,

|{fallen_vegetation_over_train_tracks_structure}_[impede]_{any_trained_computer_vision_agent_perception_capability}|,

|{fallen_vegetation_over_train_tracks_structure}_[obstruct]_{powered_powerlines_cables_structure_visual_appearance}|,

|{fallen_vegetation_over_train_tracks_structure}_[generate]_{leaves_&_pollen}|covered in 3.5covered in 4.5covered in 5.5

unsafe_scenario7.1

|{police_force}_[-monitor]_{roaming_adversarial_drone}|,

|{police_force}_[+support]_{safe_secure_train_track_zone}|,

|{police_force}_[+direct]_{police_officer_situational_awareness}|

unsafe_scenario7.2

|{police_officer_situational_awareness}_[+monitor]_{passing_train_approach}|,

|{police_officer_situational_awareness}_[+support]_{safe_secure_train_track_zone}|,

|{police_officer_situational_awareness}_[+support]_{safe_secure_police_officer}|

unsafe_scenario8.1

|{roaming_adversarial_drone}_[-avoid]_{police_officer_situational_awareness}|,

|{roaming_adversarial_drone}_[-impede]_{all_trains_operations}|,

|{roaming_adversarial_drone}_[-avoid]_{police_officer_capture_adversarial_drone}|

unsafe_scenario8.2

|{roaming_adversarial_drone}_[-avoid]_{police_officer_situational_awareness}|,

|{roaming_adversarial_drone}_[-impede]_{police_officer_capture_adversarial_drone}|,

|{roaming_adversarial_drone}_[-fly_over]_{free_space_above_train_roof}|

unsafe_scenario9.1

|{stationary_train}_[support]_{roaming_adversarial_drone}|,

|{stationary_train}_[impede]_{police_officer_capture_adversarial_drone}|,

|{stationary_train}_[obstruct]_{police_officer_movements}|

unsafe_scenario9.2

|{roaming_adversarial_drone}_[appreciate]_{powered_powerlines_cables_structure_visual_appearance}|,

|{roaming_adversarial_drone}_[-impede]_{police_officer_capture_adversarial_drone}|,

|{roaming_adversarial_drone}_[-hover]_{free_space_above_train_roof}|

below is the list of the remaining discovered factors

['moving_train', 'unsafe_train_tracks_zone_structure', 'moving_train', 'roaming_adversarial_drone', 'invisible_roaming_adversarial_drone', 'moving_train', 'train_driver_situational_awareness', 'moving_train', 'unaware_train_driver_situational_awareness', 'roaming_adversarial_drone', 'moving_train', 'random_vegetation_motion', 'random_vegetation_motion', 'any trained computer vision agent_perception_capability', 'moving_train', 'extended_train_pantograph', 'extended_train_pantograph', 'powered_powerlines_cables_structure_sparks', 'powered_powerlines_cables_structure_sparks', 'functional_any_trained_computer_vision_agent_perception_capability', 'extended_train_pantograph', 'powered_powerlines_cables_structure_visual_appearance', 'moving_train_wheels', 'random_train_tracks_structure_sparks', 'invisible_roaming_adversarial_drone_visual_appearance', 'train_driver_situational_awareness', 'roaming_adversarial_drone', 'moving_train', 'moving_train', 'approaching_adversarial_drone', 'roaming_adversarial_drone', 'visible_train_visual_appearance', 'roaming_adversarial_drone_perception_capability', 'visible_train_tracks_appearance', 'visible_train_tracks_appearance', 'roaming_adversarial_drone_perception_capability', 'roaming_adversarial_drone_perception_capability',

Appendix J

'visible_train_tracks_appearance', 'roaming_adversarial_drone', 'train_tracks_zone_fence_structure', 'roaming_adversarial_drone', 'visible_train_tracks_zone_fence_structure', 'roaming_adversarial_drone', 'clear_train_tracks_zone_open_space', 'roaming_adversarial_drone', 'clear_train_tracks_zone_open_space', 'roaming_adversarial_drone_perception_capability', 'visible_train_tracks_zone_fence_visual_appearance', 'roaming_adversarial_drone_camera', 'visible_train_tracks_zone_fence_structure', 'roaming_adversarial_drone', 'visible_vegetation_visual_appearance', 'roaming_adversarial_drone', 'visible_vegetation_structure', 'roaming_adversarial_drone', 'powered_powerlines_cables_structure_visual_appearance', 'roaming_adversarial_drone', 'powered_powerlines_cables_structure_visual_appearance', 'roaming_adversarial_drone', 'powered_powerlines_cables_structure_visual_appearance', 'visible_train_tracks_appearance', 'roaming_adversarial_drone', 'clear_train_tracks_visual_appearance', 'roaming_adversarial_drone', 'visible_train_tracks_appearance', 'visible_train_tracks_zone_fence_visual_appearance', 'visible_train_tracks_appearance', 'visible_powered_powerlines_cables_structure_visual_appearance', 'visible_train_tracks_zone_fence_structure', 'visible_vegetation_visual_appearance', 'visible_vegetation_visual_appearance', 'any_trained_computer_vision_agent_perception_capability', 'visible_vegetation_visual_appearance', 'roaming_adversarial_drone_perception_capability', 'train_tracks_zone_fence_structure', 'vegetation_structure', 'visible_train_tracks_zone_fence_visual_appearance', 'visible_powered_powerlines_cables_structure_visual_appearance', 'overgrown_vegetation_structure', 'moving_train', 'visible_fallen_vegetation_structure', 'visible_train_tracks_appearance', 'visible_vegetation_visual_appearance', 'visible_train_tracks_zone_fence_visual_appearance', 'visible_vegetation_visual_appearance', 'visible_powered_powerlines_cables_structure_visual_appearance', 'visible_powered_powerlines_cables_structure_visual_appearance', 'train_tracks_appearance', 'visible_powered_powerlines_cables_structure_visual_appearance', 'visible_train_tracks_zone_fence_visual_appearance', 'visible_powered_powerlines_cables_structure', 'visible_vegetation_visual_appearance', 'incapable_police_officer_situational_awareness', 'roaming_adversarial_drone', 'incapable_police_officer_situational_awareness', 'moving_train', 'roaming_adversarial_drone', 'incapable_pursuing_police_officers', 'roaming_adversarial_drone', 'static_train', 'roaming_adversarial_drone', 'incapable_pursuing_police_officers', 'static_train', 'incapable_pursuing_police_officers', 'incapable_pursuing_police_officers', 'roaming_adversarial_drone', 'static_train', 'flying_adversarial_drone']

J.1.4 Predictive Thinking Pipeline 4: Predict and Evaluate Problem Domain Factors and Assumptions.

Step 4.1) Perform the most and least frequent factor evaluation

To perform this analysis, we needed to extract all the factors mentioned above and count their frequencies. The frequency of mention indicates the degree of emphasis we place on their influence on our peripheral perception of the problem. The following is Python code that we used to do so:

```
import csv
from collections import Counter


def extract_text_in_parentheses():
"""
This code accepts text of any length and searches for specific characters to extract the text located between those characters. We employ the following format to define interactions:
({roaming_adversarial_drone}_[appreciate]_{powered_powerlines_structure}), where a factor is defined within curly braces {} and an action is enclosed within square brackets []. This script has been utilised to extract the factors and compile them into a list. Please execute this script in a local Python environment.

"""
    # Prompt the user to enter a text
    input_text = input("enter your text: ")

    # List to store extracted phrases
    extracted_phrases = []

    # Temporary string to build phrases
    temp_phrase = ""
```

```
    inside_parentheses = False

    # Iterate through each character in the text
    for char in input_text:
        if char == '{': # choose the opening character
            inside_parentheses = True
            temp_phrase = ""
        elif char == '}' and inside_parentheses: # choose the closing character
            inside_parentheses = False
            # Add the phrase to the list
            extracted_phrases.append(temp_phrase)
        elif inside_parentheses:
            temp_phrase += char

    return extracted_phrases

predicted_factors = extract_text_in_parentheses()
print("------------------------------------------------------------")
print("------------------------------------------------------------")
print("------------------------------------------------------------")
print("------------------------------------------------------------")
print(predicted_factors)

def generate_histogram_and_csv(data_list):
```

```
# Count the frequency of each element in the list
frequency_count = Counter(data_list)

# Calculate total occurrences for influence level calculation
total_occurrences = sum(frequency_count.values())

# Create a list of dictionaries for CSV writing
csv_data = []
for factor, freq in frequency_count.items():
    influence_level = freq / total_occurrences
    csv_data.append({
        "Predicted Factor": factor,
        "Frequency": freq,
        "Influence Level": influence_level
    })

# Sort the list by frequency in descending order
csv_data.sort(key=lambda x: x["Frequency"], reverse=True)

# Write data to CSV file
with open(r'C:\Users\hal1e20\python_ver\python_projects\Systems_Science\predicted_factors.csv', 'w', newline='') as file:
    writer = csv.DictWriter(file, fieldnames=["Predicted Factor", "Frequency", "Influence Level"])
    writer.writeheader()
    writer.writerows(csv_data)
```

```
    return r"C:\Users\hal1e20\python_ver\python_projects\Systems_Science\predicted_factors.csv"


# Example usage with a list of elements
#example_data = ["factor1", "factor2", "factor1", "factor3", "factor2", "factor1"]
#csv_file_path = generate_histogram_and_csv(example_data)
csv_file_path = generate_histogram_and_csv(predicted_factors)


print(csv_file_path) # output the location of the CSV file that computes the frequency of factors during analysis
```

Step 4.3) Define the assumptions made about factors

In this step, we used the Python script from step 4.1 and changed the format of interactions from: | interaction | to < interaction >. Then instructed the code to capture any text in between <> . In this version of the process, we include only the full interaction and prompt the architect to describe the associated assumption with the interaction.

Table J.8 unsafe train tracks problem domain assumptions

Assumption label	Predicted interaction	Architect Prediction (assumption)
1	{roaming_adversarial_drone}_[-lead] _{train_derailment}	An assumption that roaming adversarial drones could potentially lead to train derailment.
2	{moving_train}_[approach] _{unsafe_train_tracks_zone_structure}	It is assumed that as a moving train approaches, it may inadvertently interact with unsafe or poorly structured train tracks zones.
3	{moving_train}_[prevent] _{unsafe_unsecured_passengers_and_goods}	The assumption that moving trains may be unintentionally prevent risks associated with unsafe or unsecured passengers and goods.

4	{roaming_adversarial_drone}_[+govern] _{roaming_adversarial_drone_flight_dynamics}	It is assumed that roaming adversarial drones can positively influence or govern their flight dynamics for certain operations.
5	{moving_train}_[maintains] _{safe_passengers_and_goods}	Assuming that moving trains inherently maintain safety for passengers and goods during their operation.
6	{moving_train}_[inform] _{train_driver_situational_awareness}	An assumption that moving trains provide information that enhances train driver situational awareness.
7	{moving_train}_[communicate] _{roaming_adversarial_drones_location_data}	The assumption that moving trains communicate or exchange data related to the location of roaming adversarial drones.
8	{moving_train}_[communicate] _{roaming_adversarial_drones_information}	It is assumed that moving trains communicate information related to roaming adversarial drones.
9	{moving_train}_[trigger_communication] _{unaware_emergency_response_teams}	The assumption that moving trains trigger communication with emergency response teams who may be unaware of certain circumstances.
10	{roaming_adversarial_drone}_[maintain] _{low_altitude_roaming_adversarial_drone}	An assumption that invisible roaming adversarial drones maintain a low altitude during their operations.
11	{roaming_adversarial_drone}_[employ] _{roaming_adversarial_drone_camouflage}	The assumption that invisible roaming adversarial drones employ camouflage techniques during operations.
12	{roaming_adversarial_drone}_[suppress] _{roaming_adversarial_drone_noise_emissions}	Assuming that invisible roaming adversarial drones suppress noise emissions to avoid detection.
13	{roaming_adversarial_drone}_[exploit] _{moving_train_blind_spots}	An assumption that invisible roaming adversarial drones exploit the blind spots of moving trains for their operations.

14	{roaming_adversarial_drone}_[monitor] _{weather_conditions}	It is assumed that invisible roaming adversarial drones monitor weather conditions for operational advantages.
15	{roaming_adversarial_drone}_[-recognise] _{powered_powerlines_cables_structure_visual_appearance}	The assumption that roaming adversarial drones recognize powered powerlines cables based on their visual appearance.
`16	{train_tracks_structure}_[ignore] _{train_tracks_structure_visual_appearance}	Assuming that train tracks structures ignore certain visual appearances during their operations.
17	{train_tracks_structure}_[impede] _{any_trained_computer_vision_agent_perception_capability}	An assumption that train tracks structures impede the perception capability of any trained computer vision agents.
18	{vegetation_complexity_growth}_[generate] _{vegetation_complex_shapes_sizes_visual_appearance}	It is assumed that vegetation complexity growth generates various shapes and sizes with distinct visual appearances.
19	{fallen_vegetation_over_train_tracks_structure}_[follow] _{passing_train_season_&_wind}	An assumption that fallen vegetation over train tracks structures follows the patterns influenced by passing train seasons and wind conditions.
20	{fallen_vegetation_over_train_tracks_structure}_[impede] _{any_trained_computer_vision_agent_perception_capability}	An assumption that fallen vegetation over train tracks impedes the perception capability of any trained computer vision agents.
21	{roaming_adversarial_drone}_[-avoid] _{police_officer_situational_awareness}	Assuming that roaming adversarial drones actively avoid detection by police officers to maintain situational awareness.
22	{roaming_adversarial_drone}_[-impede] _{police_officer_capture_adversarial_drone}	It is assumed that roaming adversarial drones impede efforts by police officers to capture them.
23	{moving_train}_[direct] _{unaware_train_driver_situational_awareness}	An assumption that moving trains directly impact the situational awareness of unaware train drivers.

24	{moving_train}_[ignore] _{roaming_adversarial_drone}	Assuming that moving trains ignore the presence of invisible roaming adversarial drones during their operations.
25	{moving_train}_[lead] _{unsafe_unsecured_passengers_and_goods}	The assumption that moving trains lead to unsafe conditions for unsecured passengers and goods.
26	{moving_train}_[control] _{onboard_train_safety_systems}	It is assumed that moving trains control onboard safety systems to ensure passenger and crew safety.
27	{moving_train}_[control] _{alert_systems}	Assuming that moving trains control alert systems to notify personnel of potential hazards or malfunctions.
28	{moving_train}_[activate] _{onboard_train_safety_systems}	An assumption that moving trains activate onboard safety systems to prevent accidents and ensure operational safety.
29	{moving_train}_[trigger] _{alert_systems}	Assuming that moving trains trigger alert systems to alert personnel of critical situations or emergencies.
30	{moving_train}_[alert] _{train_driver_situational_awareness}	An assumption that moving trains alert train drivers to enhance their situational awareness during operations.
31	{moving_train}_[appreciate] _{track_zone_monitoring_systems}	It is assumed that moving trains appreciate the presence and functionality of track zone monitoring systems.
32	{moving_train}_[initiate_collection] _{track_zone_monitoring_systems_data}	An assumption that moving trains initiate the collection of data from track zone monitoring systems for operational insights.
33	{moving_train}_[acknowledge] _{timely_track_zone_monitoring_systems_data}	Assuming that moving trains acknowledge the importance of timely data from track zone monitoring systems for operational decisions.
34	{moving_train}_[acknowledge] _{accurate_track_zone_monitoring_systems_data}	It is assumed that moving trains acknowledge the significance of accurate data from track

		zone monitoring systems for reliable operational insights.
35	{moving_train}_[highlight] _{track_zone_monitoring_systems_data_ gaps_or_inconsistencies }	An assumption that moving trains highlight gaps or inconsistencies in data collected from track zone monitoring systems for corrective actions.
36	{moving_train}_[approach] _{roaming_adversarial_drone}	Assuming that moving trains unintendedly approach roaming adversarial drones during their operations.
37	{moving_train}_[minimize] _{roaming_adversarial_drones}	An assumption that moving trains minimize the impact of roaming adversarial drones on their operations.
38	{moving_train}_[inform] _{available_ground_based_security_systems}	It is assumed that moving trains inform personnel about the availability of ground-based security systems for enhanced safety measures.
39	{moving_train}_[communicate] _{available_ground_based_security_systems}	Assuming that moving trains communicate with personnel about the availability and functionality of ground-based security systems.
40	{moving_train}_[establish_connection] _{available_ground_based_security_systems}	An assumption that moving trains establish connections with available ground-based security systems for enhanced safety measures.
41	{moving_train}_[transmit_data_packets] _{onboard_train_communication_interface}	Assuming that moving trains transmit data packets through the onboard train communication interface for operational communication.
42	{moving_train}_[filter] _{roaming_adversarial_drones_size_data}	It is assumed that moving trains filter data related to the size of roaming adversarial drones for operational insights.
43	{moving_train}_[filter] _{roaming_adversarial_drones_location_data}	An assumption that moving trains filter data related to the location of roaming adversarial drones for operational insights.

44	{moving_train}_[filter] _{roaming_adversarial_drones_flying_behaviour_data}	Assuming that moving trains filter data related to the flying behaviour of roaming adversarial drones for operational insights.
45	{moving_train}_[prioritize] _{roaming_adversarial_drones_critical_data}	It is assumed that moving trains prioritize critical data related to roaming adversarial drones for immediate action.
46	{moving_train}_[format] _{roaming_adversarial_drones_information_transmitted_data}	An assumption that moving trains format information related to roaming adversarial drones before transmitting it for clarity and accuracy.
47	{moving_train}_[establish_connection] _{designated_emergency_response_communication_system}	Assuming that moving trains establish connections with designated emergency response communication systems for coordinated actions during emergencies.
48	{moving_train}_[transmit] _{onboard_train_communication_interface} {emergency_notification}	An assumption that moving trains transmit emergency notifications through the onboard train communication interface for immediate response.
49	{moving_train}_[appreciate] _{available_ground_based_security_systems}	It is assumed that moving trains appreciate the presence and functionality of available ground-based security systems for enhanced operational safety.
50	{moving_train}_[appreciate] _{reliable_railways_communication_network}	An assumption that moving trains appreciate the reliability of railways communication networks for operational efficiency and safety.
51	{moving_train}_[appreciate] _{accurate_track_zone_monitoring_systems}	Assuming that moving trains appreciate the accuracy of track zone monitoring systems for enhanced safety and operational awareness.
52	{moving_train}_[monitor] _{available_ground_based_security_systems}	It is assumed that moving trains monitor available ground-based security systems for potential threats and safety measures.

53	{moving_train}_[monitor] _{communication_network_connectivity }	An assumption that moving trains monitor communication network connectivity for reliable operational communication.
54	{moving_train}_[establish] _{alternative_communication_channels}	Assuming that moving trains establish alternative communication channels for redundant operational communication.
55	{moving_train}_[verify] _{track_zone_monitoring_systems_data_plausibility}	It is assumed that moving trains verify the plausibility of data from track zone monitoring systems for accuracy in decision-making.
56	{moving_train}_[confirms] _{ground_based_security_systems_ received_data}	An assumption that moving trains confirm the reception of data from ground-based security systems for timely response to threats.
57	{moving_train}_[assess] _{disruptive_adversarial _drones_threat_severity}	Assuming that moving trains assess the severity of threats posed by disruptive adversarial drones for appropriate response measures.
58	{roaming_adversarial_drone}_[approach] _{moving_train}	An assumption that invisible roaming adversarial drones approach moving trains for potential interference or observation goals.
59	{roaming_adversarial_drone}_[influence] _{train_driver_situational_awareness}	It is assumed that invisible roaming adversarial drones influence train driver situational awareness through their presence or actions.
60	{roaming_adversarial_drone}_[influence] _{onboard_train_safety_systems}	An assumption that invisible roaming adversarial drones influence onboard train safety systems for potential disruption or compromise.
61	{roaming_adversarial_drone}_[control] _{altitude_control_systems}	Assuming that invisible roaming adversarial drones can control altitude control systems to manipulate flight height.
62	{roaming_adversarial_drone}_[control] _{camouflage_mechanisms}	An assumption that invisible roaming adversarial drones control camouflage mechanisms to avoid detection.

63	{roaming_adversarial_drone}_[control] _{roaming_adversarial_drone_noise_suppression_systems}	Assuming that invisible roaming adversarial drones control noise suppression systems to reduce their detectability.
64	{roaming_adversarial_drone}_[control] _{roaming_adversarial_drone_navigation_systems}	An assumption that invisible roaming adversarial drones control navigation systems to maneuver effectively.
65	{roaming_adversarial_drone}_[adjust] _{altitude_parameters}	Assuming that invisible roaming adversarial drones adjust altitude parameters to maintain covert operations.
66	{roaming_adversarial_drone}_[activate] _{camouflage_mechanisms}	An assumption that invisible roaming adversarial drones activate camouflage mechanisms to blend into the environment.
67	{roaming_adversarial_drone}_[reduce] _{roaming_adversarial_drone_noise_output}	Assuming that invisible roaming adversarial drones reduce noise output to avoid detection or suspicion.
68	{roaming_adversarial_drone}_[optimize] _{path_planning_algorithms}	An assumption that invisible roaming adversarial drones optimize path planning algorithms to evade detection or navigate efficiently.
69	{roaming_adversarial_drone}_[adapt] _{adversarial_drone_response_strategies}	Assuming that invisible roaming adversarial drones adapt their strategies to counter response measures.
70	{roaming_adversarial_drone}_[appreciate] _{weather_conditions}	An assumption that invisible roaming adversarial drones appreciate weather conditions to adjust flight actions accordingly.
71	{roaming_adversarial_drone}_[appreciate] _{train_schedule_timing}	Assuming that invisible roaming adversarial drones appreciate train schedule timing to synchronize activities or avoid detection.
72	{roaming_adversarial_drone}_[appreciate] _{train_tracks_ maintenance_activities}	An assumption that invisible roaming adversarial drones appreciate train tracks maintenance activities to exploit vulnerabilities or avoid detection.

73	{roaming_adversarial_drone}_[appreciate] _{track_zone_obstacles}	Assuming that invisible roaming adversarial drones appreciate track zone obstacles to navigate or avoid detection.
74	{roaming_adversarial_drone}_[synchronize] _{train_schedule_timing}	An assumption that invisible roaming adversarial drones synchronize with train schedule timing to perform actions or avoid detection during critical periods.
75	{roaming_adversarial_drone}_[scan] _{train_tracks_ maintenance_activities}	Assuming that invisible roaming adversarial drones scan train tracks maintenance activities to gather intelligence or plan actions.
76	{roaming_adversarial_drone}_[detect] _{track_zone_obstacles}	An assumption that invisible roaming adversarial drones detect track zone obstacles to adjust flight path or avoid collisions.
77	{roaming_adversarial_drone}_[adapt] _{flight_path_based_on_weather}	Assuming that invisible roaming adversarial drones adapt flight paths based on current weather conditions to maintain operational effectiveness.
78	{roaming_adversarial_drone}_[plan] _{routes_around_maintenance_activities}	An assumption that invisible roaming adversarial drones plan routes around train maintenance activities to avoid detection or disruption.
79	{roaming_adversarial_drone}_[navigate] _{adversarial_drone_dangerous_navigation_around_obstacles}	Assuming that invisible roaming adversarial drones navigate dangerous paths around obstacles to maintain covert operations.
80	{moving_train}_[agitates] _{random_vegetation_motion}	An assumption that a moving train agitates random vegetation, potentially causing movement or disturbance in its vicinity.
81	{moving_train}_[induces] _{traveling_train_induced_air_turbulence_and_vibration}	Assuming that a moving train induces air turbulence and vibration as it passes through, affecting surrounding environment.
82	{moving_train}_[pass_through] _{fence_to_train_open_space}	An assumption that a moving train can pass through openings in fences or barriers intended to contain its path.

83	{moving_train}_[impede] _{any_trained_computer_vision_agent_perception_capability}	Assuming that a moving train might impede the perception capability of any trained computer vision agent in its path.
84	{moving_train}_[manage] _{train_electric_power_supply}	An assumption that a moving train manages its electric power supply efficiently during operation.
85	{moving_train}_[deploy] _{extended_train_pantograph}	Assuming that a moving train deploys an extended pantograph when required to maintain electrical contact with overhead wires.
86	{moving_train}_[ignore] _{free_space_above_train_roof}	An assumption that a moving train ignores the presence of free space above its roof during its journey.
87	{extended_train_pantograph}_[impede] _{any_trained_computer_vision_agent_perception_capability}	Assuming that an extended train pantograph might impede the perception capability of any trained computer vision agent near it.
88	{extended_train_pantograph}_[trigger] _{powered_powerlines_cables_structure_sparks}	An assumption that an extended train pantograph might trigger sparks when in contact with powered power lines or cables.
89	{extended_train_pantograph}_[chafe_&_wobble] _{powered_powerlines_cables_structure_visual_appearance}	Assuming that an extended train pantograph might chafe and wobble when in contact with powered power lines or cables, affecting their visual appearance.
90	{roaming_adversarial_drone}_[+manage] _{invisible_roaming_adversarial_drone_visual_appearance}	An assumption that a roaming adversarial drone can manage its visual appearance to remain invisible to detection systems.
91	{roaming_adversarial_drone}_[-navigate_around] _{train_driver_situational_awareness}	Assuming that a roaming adversarial drone navigates around obstacles, potentially obstructing train drivers' situational awareness.
92	{roaming_adversarial_drone_perception_capability}_[-trace] _{visible_train_tracks_appearance}	An assumption that the perception capability of a roaming adversarial drone can trace visible train tracks' appearance.
93	{roaming_adversarial_drone_perception_capability}_[-lead] _{train_derailment}	Assuming that the perception capability of a roaming adversarial drone can lead to train

		derailment by misguiding or interfering with tracks.
94	{roaming_adversarial_drone_perception_capability}_[+govern] _{roaming_adversarial_drone_flight_dynamics}	An assumption that the perception capability of a roaming adversarial drone can govern its flight dynamics, ensuring stable and controlled movement.
95	{roaming_adversarial_drone}_[-detect] _{visible_train_tracks_zone_fence_structure}	Assuming that a roaming adversarial drone can detect visible structures like fences around train tracks, potentially hindering its movement.
96	{roaming_adversarial_drone}_[-approach] _{train_tracks_zone_fence_structure}	An assumption that a roaming adversarial drone approaches fence structures in train track zones, potentially leading to trespassing or obstruction.
97	{roaming_adversarial_drone}_[-recognise] _{visible_vegetation_visual_appearance}	Assuming that a roaming adversarial drone can recognize visible vegetation by its appearance, potentially altering its flight path.
98	{roaming_adversarial_drone}_[-avoid] _{visible_vegetation_structure}	An assumption that a roaming adversarial drone avoids visible vegetation structures, potentially altering its flight path to evade detection or collision.
99	{roaming_adversarial_drone}_[-avoid] _{powered_powerlines_cables_structure_visual_appearance}	Assuming that a roaming adversarial drone avoids powered power lines and cables based on their visual appearance, minimizing collision risks.
100	{roaming_adversarial_drone}_[ignore] _{powered_powerlines_cables_EMF}	An assumption that a roaming adversarial drone can manage its visual appearance to remain invisible to detection systems.
101	{roaming_adversarial_drone}_[-collide] _{powered_powerlines_cables_structure}	Assuming that a roaming adversarial drone navigates around obstacles, potentially obstructing train drivers' situational awareness.
102	{train_tracks_structure}_[ignore] _{visibility_obstructive_objects}	An assumption that the perception capability of a roaming adversarial drone can trace visible train tracks' appearance.

103	{train_tracks_structure}_[lead] _{adversarial_drone_collision_with_train}	Assuming that the perception capability of a roaming adversarial drone can lead to train derailment by misguiding or interfering with tracks.
104	{train_tracks_structure}_[guide] _{roaming_adversarial_drone_perception_capability}	An assumption that the perception capability of a roaming adversarial drone can govern its flight dynamics, ensuring stable and controlled movement.
105	{train_tracks_structure}_[complicates] _{vegetation_complex_shapes_sizes_visual_appearance}	Assuming that a roaming adversarial drone can detect visible structures like fences around train tracks, potentially hindering its movement.
106	{train_tracks_structure}_[complicates] _{visible_train_tracks_zone_fence_structure_visual_appearance}	An assumption that a roaming adversarial drone approaches fence structures in train track zones, potentially leading to trespassing or obstruction.
107	{train_tracks_structure}_[complicates] _{visible_powered_powerlines_cables_structure_visual_appearance}	Assuming that a roaming adversarial drone can recognize visible vegetation by its appearance, potentially altering its flight path.
108	{train_tracks_zone_fence_structure}_[ignore] _{visible_train_tracks_zone_fence_structure_visual_appearance}	An assumption that a roaming adversarial drone avoids visible vegetation structures, potentially altering its flight path to evade detection or collision.
109	{train_tracks_zone_fence_structure}_[guide] _{roaming_adversarial_drone_perception_capability}	Assuming that a roaming adversarial drone avoids powered power lines and cables based on their visual appearance, minimizing collision risks.
110	{train_tracks_zone_fence_structure}_[demarcate] _{train_tracks_structure_visual_appearance}	An assumption that the train tracks zone fence structure demarcates the visual appearance of the train tracks' structure, potentially influencing how they are perceived visually.
111	{vegetation_complexity_growth}_[follow] _{train_tracks_zone_fence_structure}	Assuming that vegetation complexity growth follows the structure of train tracks zone

		fences, potentially affecting their maintenance and appearance.
112	{vegetation_complexity_growth}_[impede] _{any_trained_computer_vision_agent_perception_capability}	An assumption that vegetation complexity growth may impede the perception capability of any trained computer vision agents, affecting their ability to detect objects.
113	{train_tracks_zone_fence_structure}_[ignore] _{visible_powered_powerlines_cables_structure_visual_appearance}	Assuming that the train tracks zone fence structure ignores the visible appearance of powered power lines and cables, potentially affecting operational safety.
114	{train_tracks_zone_fence_structure}_[impede] _{any_trained_computer_vision_agent_perception_capability}	An assumption that the train tracks zone fence structure may impede the perception capability of any trained computer vision agents, affecting their accuracy in detecting objects.
115	{train_tracks_zone_fence_structure}_[complicates] _{visible_powered_powerlines_cables_structure_visual_appearance}	Assuming that the train tracks zone fence structure complicates the visible appearance of powered power lines and cables, potentially affecting their maintenance and safety.
116	{vegetation_complexity_growth}_[adapt] _{train_track_zone_structure}	An assumption that vegetation complexity growth adapts to the structure of train track zones, potentially influencing operational efficiency and maintenance practices.
117	{vegetation_complexity_growth}_[complicate] _{unaware_train_driver_situational_awareness}	Assuming that vegetation complexity growth complicates unaware train drivers' situational awareness, potentially impacting operational safety.
118	{fallen_vegetation_over_train_tracks_structure}_[obstruct] _{train_tracks_structure_visual_appearance}	An assumption that fallen vegetation over train tracks obstructs the visual appearance of the train tracks' structure, potentially affecting maintenance and safety inspections.
119	{fallen_vegetation_over_train_tracks_structure}_[obstruct] _{powered_powerlines_cables_structure_visual_appearance}	Assuming that fallen vegetation over train tracks obstructs the visual appearance of powered

		power lines and cables, potentially affecting operational safety and maintenance.
120	{fallen_vegetation_over_train_tracks_structure}_[generate] _{leaves_&_pollen}	An assumption that fallen vegetation over train tracks generates leaves and pollen, potentially affecting visibility and maintenance efforts.
121	{police_force}_[-monitor] _{roaming_adversarial_drone}	Assuming that the police force monitors roaming adversarial drones, potentially mitigating security risks.
122	{police_force}_[+support] _{safe_secure_train_track_zone}	An assumption that the police force supports ensuring a safe and secure train track zone, enhancing operational safety.
123	{police_force}_[+direct] _{police_officer_situational_awareness}	Assuming that the police force directs police officers to enhance situational awareness, improving response capabilities.
124	{police_officer_situational_awareness}_[+monitor] _{passing_train_approach}	An assumption that police officer situational awareness monitors approaching trains, ensuring safety and security protocols are followed.
125	{police_officer_situational_awareness}_[+support] _{safe_secure_train_track_zone}	Assuming that police officer situational awareness supports maintaining a safe and secure train track zone, enhancing operational safety.
126	{police_officer_situational_awareness}_[+support] _{safe_secure_police_officer}	An assumption that police officer situational awareness supports ensuring the safety and security of police officers themselves during operations.
127	{roaming_adversarial_drone}_[-impede] _{all_trains_operations}	Assuming that roaming adversarial drones impede train operations, potentially causing delays or disruptions.
128	{roaming_adversarial_drone}_[-avoid] _{police_officer_capture_adversarial_drone}	An assumption that roaming adversarial drones avoid capture by police officers, complicating security efforts.

129	{roaming_adversarial_drone}_[-fly_over] _{free_space_above_train_roof}	Assuming that roaming adversarial drones fly over the free space above train roofs, potentially posing security risks.
130	{stationary_train}_[support] _{roaming_adversarial_drone}	An assumption that a stationary train supports the presence of roaming adversarial drones unintentionally, possibly due to its stationary nature providing a perch or cover.
131	{stationary_train}_[impede] _{police_officer_capture_adversarial_drone}	Assuming that a stationary train inadvertently impedes police officers attempting to capture adversarial drones, potentially due to obstructed views or access.
132	{stationary_train}_[obstruct] _{police_officer_movements}	An assumption that a stationary train inadvertently obstructs police officer movements, possibly affecting response times or access to critical areas.
133	{roaming_adversarial_drone}_[appreciate] _{powered_powerlines_cables_structure_visual_appearance}	Assuming that a roaming adversarial drone appreciates the visual appearance of powered powerlines and cables structures, possibly for navigation or shelter goals.
134	{roaming_adversarial_drone}_[-hover] _{free_space_above_train_roof}	An assumption that a roaming adversarial drone hovers over the free space above train roofs, potentially posing a security risk or causing operational disruptions.