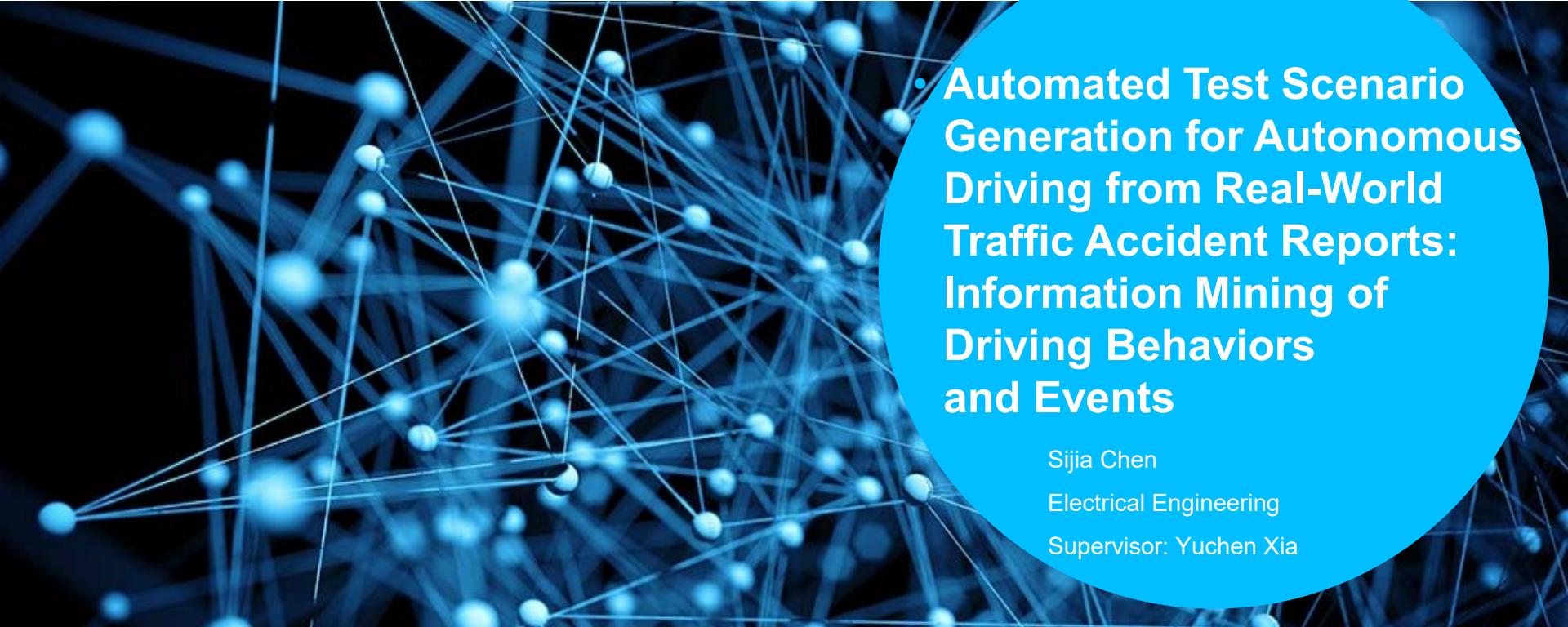




University of Stuttgart
Institute of Industrial Automation
and Software Engineering



A complex network graph composed of numerous blue glowing spheres (nodes) connected by thin blue lines (edges), set against a dark background. This visual metaphor represents the interconnectedness and mining of data in the research presented.

- **Automated Test Scenario Generation for Autonomous Driving from Real-World Traffic Accident Reports: Information Mining of Driving Behaviors and Events**

Sijia Chen
Electrical Engineering
Supervisor: Yuchen Xia



- Motivation
- Basis
- Conception Design
- Implementation
- Evaluation and Verification
- Summary and Outlook

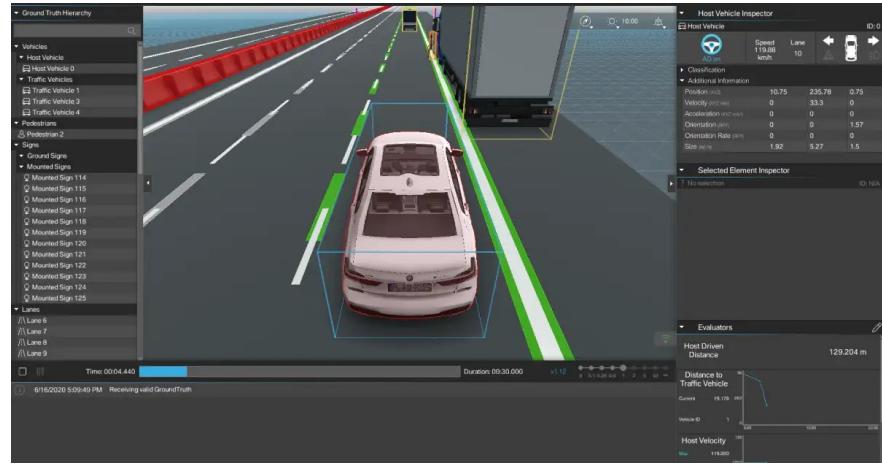


Motivation

Current Autonomous Driving Test Methods



[1]



[2]

Physical testing on public roads

- An engineer supervises the car
- Real-world experience

(!) traffic events are trivial

(!) limitation of time and physical space

Simulation Test

- Reproducible, no physical harm
- Not limited to time and physical space

(!) How real are the test cases?

(!) How risky are the test cases?

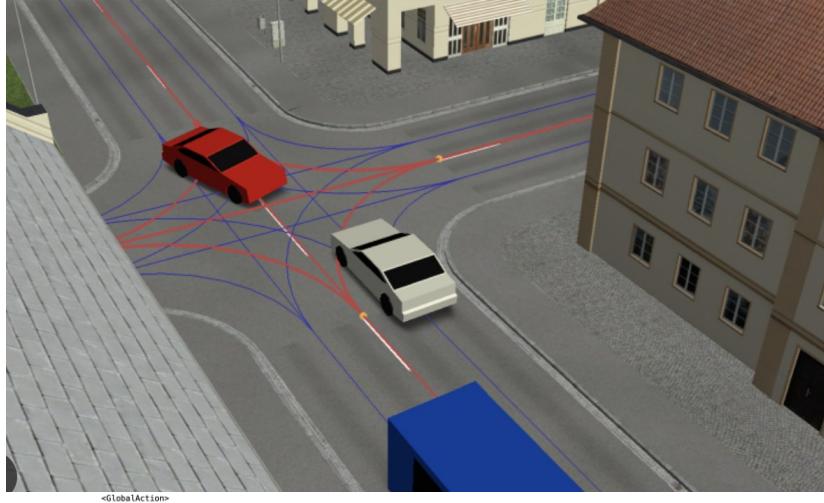
Initial ideas

Real and risky test cases?



[3]

Real Traffic Accident Reports



[4]

Simulation test case

The major problem



NMVCCS Case Viewer
Case Number: 2005-002-004
Case ID: 200502229042

Print Friendly Version of Case Print Friendly Version of View Download XML Source

Crash Overview

Case Number	4
Date	01/005
Day of Week	Friday
PM Time of Crash	09:30
Crash Level KABCOU	A - Incapacitating injury

Case Summary

The crash occurred on a two lane undivided roadway with a posted speed limit of 48 KPH (30 MPH) and a -2.2% grade. There was an intersecting driveway to the right with a +13.3% grade. The weather was clear, the roadway or and was dry/dark at the time of this early morning weekday crash.

Vehicle 1, a 1996 Chevrolet Blazer, was traveling north on the two lane undivided roadway approaching the driveway. It should be noted that there was a large sign, small hill and telephone pole to the driver's right, which may have obscured the approach of Vehicle 2. Vehicle 2, a 2000 Toyota Corolla, was traveling west on the driveway approaching the main roadway. Vehicle 2 entered the main roadway and was struck in the left side by the front of Vehicle 1. Vehicle 2 was traveling east on the main roadway, went off the road, onto the grassy shoulder, and came to rest facing west. Vehicle 1 continued and came to rest in the southbound lane facing north.

The Chevrolet Blazer (Vehicle 1) was driven by a below 55-year-old male who was unharmed, treated and released with no complaint of pain. Vehicle 1 was traveling north on the roadway and saw Vehicle 2 coming down the drive off to the right. He put on his brakes and steered right but hit Vehicle 2 on the left side. Vehicle 1 was slowed due to damage.

The Critical Precursor Event of Vehicle 1 was the encroachment of the other vehicle from a driveway, intended path not known. The Critical Reason for the Critical Event was not coded to this vehicle. A possible contributing factor to this crash may have been the sign, small hill and pole to the driver's right, which may have limited his sight of Vehicle 2's approach. No other associated factors were coded to the driver of the Blazer and he was not thought to be contributing to the crash.

The Toyota Corolla (Vehicle 2) was driven by a below 23-year-old female who was transported, treated and hospitalized for 1 day due to a head injury. The driver of the Corolla stated that she had "blacked out" and did not recall the events preceding the accident. Vehicle 2 was slowed due to damage.

The Critical Precursor Event for Vehicle 2 was its unknown travel direction. This was chosen due to no indication of turning left or right and the incapacitating illness of the driver. The Critical Reason for the Critical Event was the physical impairment of the ability of the driver. An associated factor coded to this driver was the use of prescription medications. She was taking two medications: a birth control pill and an antihistamine. They did not contribute to the crash.

Factor Summary

Aggravating Behavior	Vehicle 1	Vehicle 2
Alcohol	Present	Present
Cargo Shift		
Cell Phone Use		
Deflection		
Distraction		
Driver Fatigued		
Driver Inexperience		
Driver Physical		
Driver Stress/Emotion		
Roadway		
Speed/Distance		



```
<?xml version="1.0" encoding="UTF-8"?>
<OpenSCEANARIO>
<fileHeader revMajor="1" revMinor="0" date="2020-03-20T12:00:00" description="CARLA:FollowLeadingVehicle" author="" />
<parameterDeclarations>
  <parameterDeclaration name="leadingSpeed" parameterType="double" value="2.0"/>
</parameterDeclarations>
<roadNetwork>
  <logicFile filepath="Town01"/>
</roadNetwork>
<entities>
  <ScenarioObject name="Henz">
    <vehicle name="vehicle.lincoln.mkz_2017" vehicleCategory="car">
      <ParameterDeclarations/>
      <Performance maxSpeed="69.444" maxAcceleration="200" maxDeceleration="10.0"/>
      <Dimensions>
        <Center x="1.5" y="0" z="0.9"/>
        <Dimensions width="2.1" length="4.5" height="1.8"/>
      </Dimensions>
      <BoundingBox>
        <Axes>
          <frontAxe maxSteering="0.5" wheelDiameter="0.6" trackWidth="1.8" positionX="3.1" positionZ="0.3"/>
          <rearAxe maxSteering="0.5" wheelDiameter="0.6" trackWidth="1.8" positionX="0.0" positionZ="0.3"/>
        </Axes>
      </BoundingBox>
      <Properties>
        <property name="type" value="ego_vehicle"/>
        <property name="color" value="#0,0,255"/>
      </Properties>
    </Vehicle>
  </ScenarioObject>
  <ScenarioObject name="adversary">
    <vehicle name="vehicle.tesla.model3" vehicleCategory="car">
      <ParameterDeclarations/>
      <Performance maxSpeed="69.444" maxAcceleration="200" maxDeceleration="10.0"/>
      <Dimensions>
        <Center x="1.5" y="0" z="0.9"/>
        <Dimensions width="2.1" length="4.5" height="1.8"/>
      </Dimensions>
      <BoundingBox>
        <Axe>
          <frontAxe maxSteering="0.5" wheelDiameter="0.6" trackWidth="1.8" positionX="3.1" positionZ="0.3"/>
          <rearAxe maxSteering="0.5" wheelDiameter="0.6" trackWidth="1.8" positionX="0.0" positionZ="0.3"/>
        </Axe>
      </BoundingBox>
      <Properties>
        <property name="type" value="simulation"/>
        <property name="color" value="255,0,0"/>
      </Properties>
    </Vehicle>
  </ScenarioObject>
</Entities>
<Storyboard>
  <List>
    <Action>
      <GlobalAction>
        <EnvironmentAction>
          <Environment name="Environment1">
            <TimeOfDay animation="false" dateTime="2020-03-20T12:00:00"/>
            <Weather cloudState="Free"/>
          </Environment>
        </EnvironmentAction>
      </GlobalAction>
    </Action>
  </List>
</Storyboard>

```

Real Traffic Accident Reports

- Unstructured data

Simulation Cases (OpenSCEANARIO file)

- Store the structured information of a driving scenario



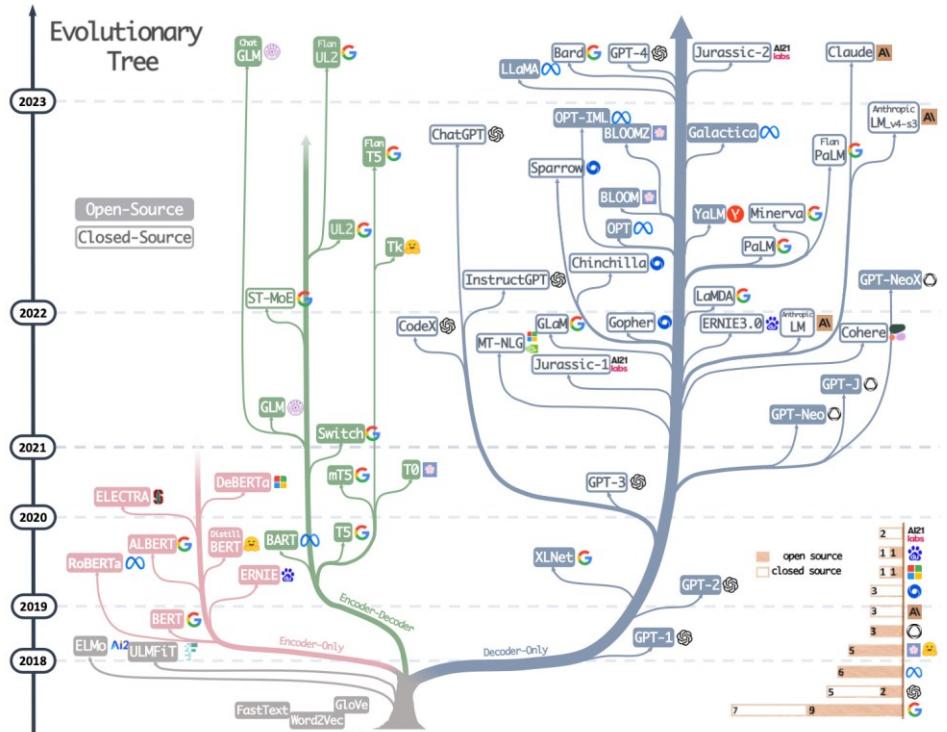
Natural Language Processing

- Motivation
- Basis
- Conception Design
- Implementation
- Evaluation and Verification
- Summary and Outlook



Basis

Large Language Models



[5]

Text interpretation

Solve a complex task

Answer a question

Generation capability

→ **Generate test cases?**

LLM fails



Text and Images Only

Print Friendly Version of Case

NMVCCS Case Viewer

Case Number: 2005-002-004

Case ID: 200502220942

Print Friendly Version of Current View

Download XML Source



NMVCCS Case
- Case Summary
- Vehicle 1
- Vehicle 2

Crash Overview
Case Number: 4
Date: 01/2005
Day of Week: Friday
PM/TM of Crash: 09:30
Crash Level: KABCOU
A - Incapacitating Injury

Case Summary
The crash occurred on a two lane, undivided roadway with a posted speed limit of 48 KPH (30 MPH) and a -2.2% grade. There was an intersecting driveway to the right with a -13.2% grade. The weather was clear, the roadway dry and the day bright at the time of this early morning weekday accident.

Vehicle 1, a 1996 Chevrolet Blazer, was traveling north on the two lane undivided roadway approaching the driveway. It should be noted that there was a large sign, small hill and telephone pole to this driver's right, which may have obscured the approach of Vehicle 2. Vehicle 2, a 2000 Toyota Corolla, was traveling west on the driveway approaching the main roadway. Vehicle 2 entered the main roadway and was struck in the left side by the front of Vehicle 2 was rotated counter-clockwise off the left side of the roadway, over a small curb, onto a private lawn and came to rest facing east. Vehicle 1 continued and came to rest in the southbound lane facing north.

The Chevrolet Blazer (Vehicle 1) was driven on a paved road and was traveling at a moderate rate of speed. The driver of the Blazer stated that he had a complaint of pain. Vehicle 1 was traveling north on the roadway and saw Vehicle 2 coming down the drive off to the right. He put on his brakes and stopped but hit Vehicle 2 in the left side. Vehicle 1 was towed due to damage.

The Toyota Corolla (Vehicle 2) was driven by a female 23 year old female who was transported, treated and hospitalized for 1 day due to a head injury. The driver of the Corolla stated that she had "blacked out" and did not recall the accident or the events preceding the accident. Vehicle 2 was towed due to damage.

The Critical Precursor Event for Vehicle 2 was its unknown travel direction. This was chosen due to no indication of turning left or right and the incapacitating illness of the driver. The Critical Reason for the Critical Event was the physical impairment of the ability of the driver. An associated factor coded to the driver was the use of prescription medications. She was taking two medications: a birth control pill and an antihistamine. They did not contribute to the crash.

Fader Summary
Aggressive Behavior
Alcohol
Cargo Shift
Cell Phone Use
Defensive
Distraction
Driver Fatigue
Driver Inexperience
Driver Performance
Driver Physical
Driver Stress/Emotion
Drugs
Roadway
Speed/Distance

Vehicle 1

Vehicle 2

Present
Present



ChatGPT

Creating a complete OpenSCENARIO file based on the detailed accident report you provided would be quite complex, as it requires a deep understanding of both the OpenSCENARIO XML schema and the specific details of the accident. However, I can provide you with a basic structure for an OpenSCENARIO XML file that you could expand upon. Here's a simplified example:

```
<?xml version="1.0" encoding="UTF-8"?>
<OpenSCENARIO xmlns="http://www.openscenario.org/schema/1.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.openscenario.org/schema/1.0 OpenSCENARIO.xsd">
  <FileHeader revMajor="1" revMinor="0" description="Two-vehicle crash scenario" author="Your Name" />

  <ParameterDeclarations>
    <!-- Define any necessary parameters here -->
  </ParameterDeclarations>

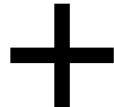
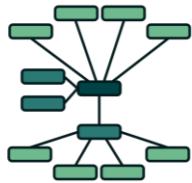
  <Entities>
    <ScenarioObject name="V1">
      <Vehicle name="FordRanger1999" vehicleCategory="car">
        <!-- Vehicle V1 properties -->
      </Vehicle>
    </ScenarioObject>
    <ScenarioObject name="V2">
      <Vehicle name="Peterbilt379_1992" vehicleCategory="truck">
        <!-- Vehicle V2 properties -->
      </Vehicle>
    </ScenarioObject>
    <!-- Define the prized hog as a miscellaneous object -->
    <MiscObject name="PrizedHog" miscObjectCategory="animal" mass="130"/>
  </Entities>
```

Real Traffic Accident Reports

- (!) LLM fails in generating OpenSCENARIO files
- (!) Hallucination

Hypothesis

Add a new ingredient: Ontology

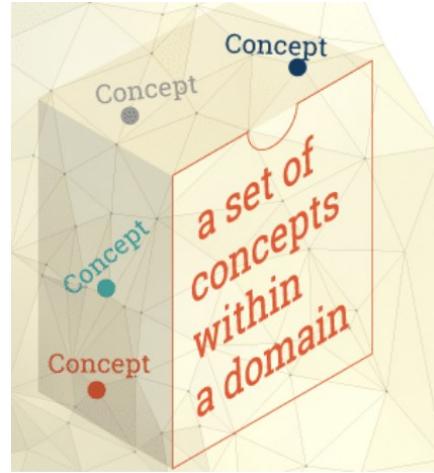


Better performance?

- Ontology provide more semantic information
- Reference to understand domain concepts and knowledge

Basis

Ontology



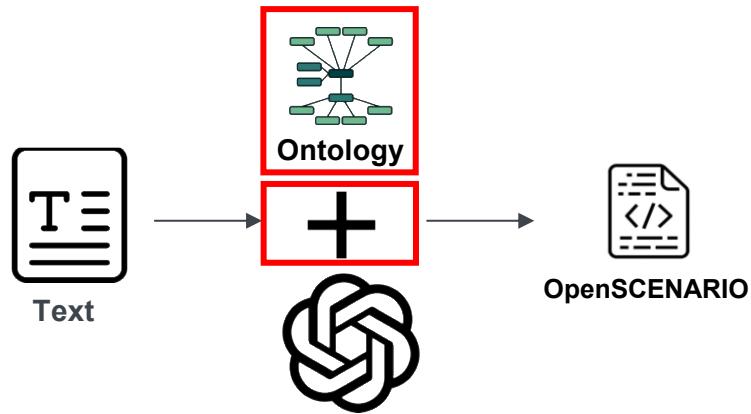
[6]

- concepts in a specific domain
- structured framework
- consistent understanding

- Motivation
- Basis
- Conception Design
- Implementation
- Evaluation and Verification
- Summary and Outlook



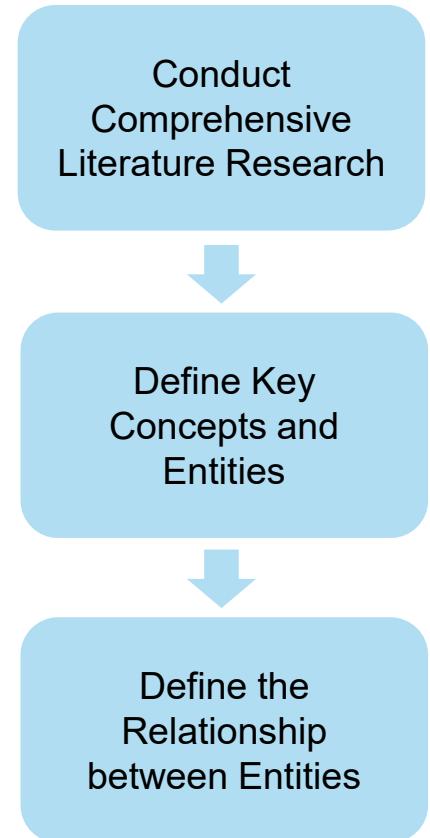
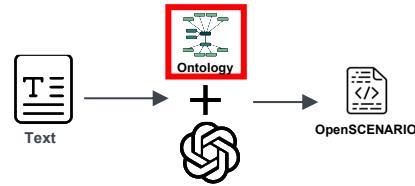
Conceptual Design



- (1) Design the ontology
- (2) Integration of ontology and LLM

Fundamental Ontology Creation

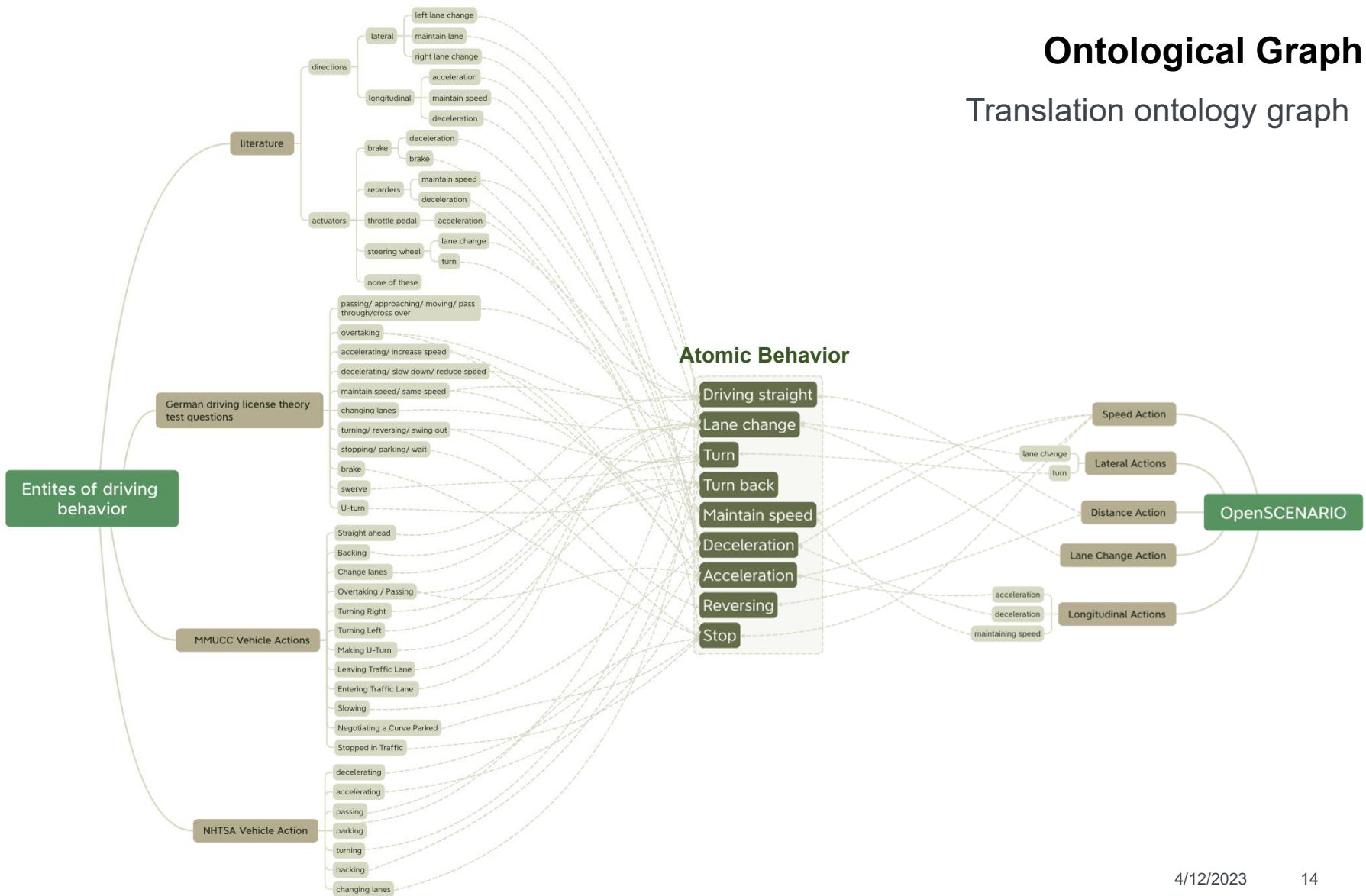
How to create the ontology?



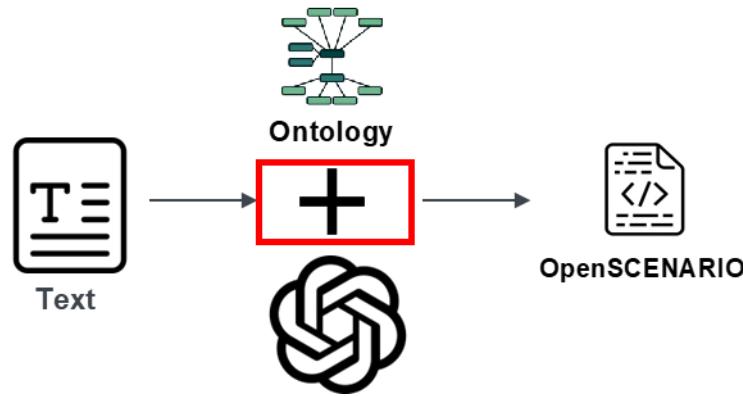
- **Google Scholar**
- **Keywords:** “driver v driving”
“behavior v event v style v maneuver”
“classification v detection v recognition”
- **Literature Research:**
 - Academic papers
 - Guidance documents
 - Driving license test questions
- Basic Driving Behaviors**
 - Driving straight
 - Lane change
 - Turn
 - Turn back
 - Stop
 - Reversing
 - Acceleration
 - Deceleration
 - Maintain speed

Ontological Graph

Translation ontology graph

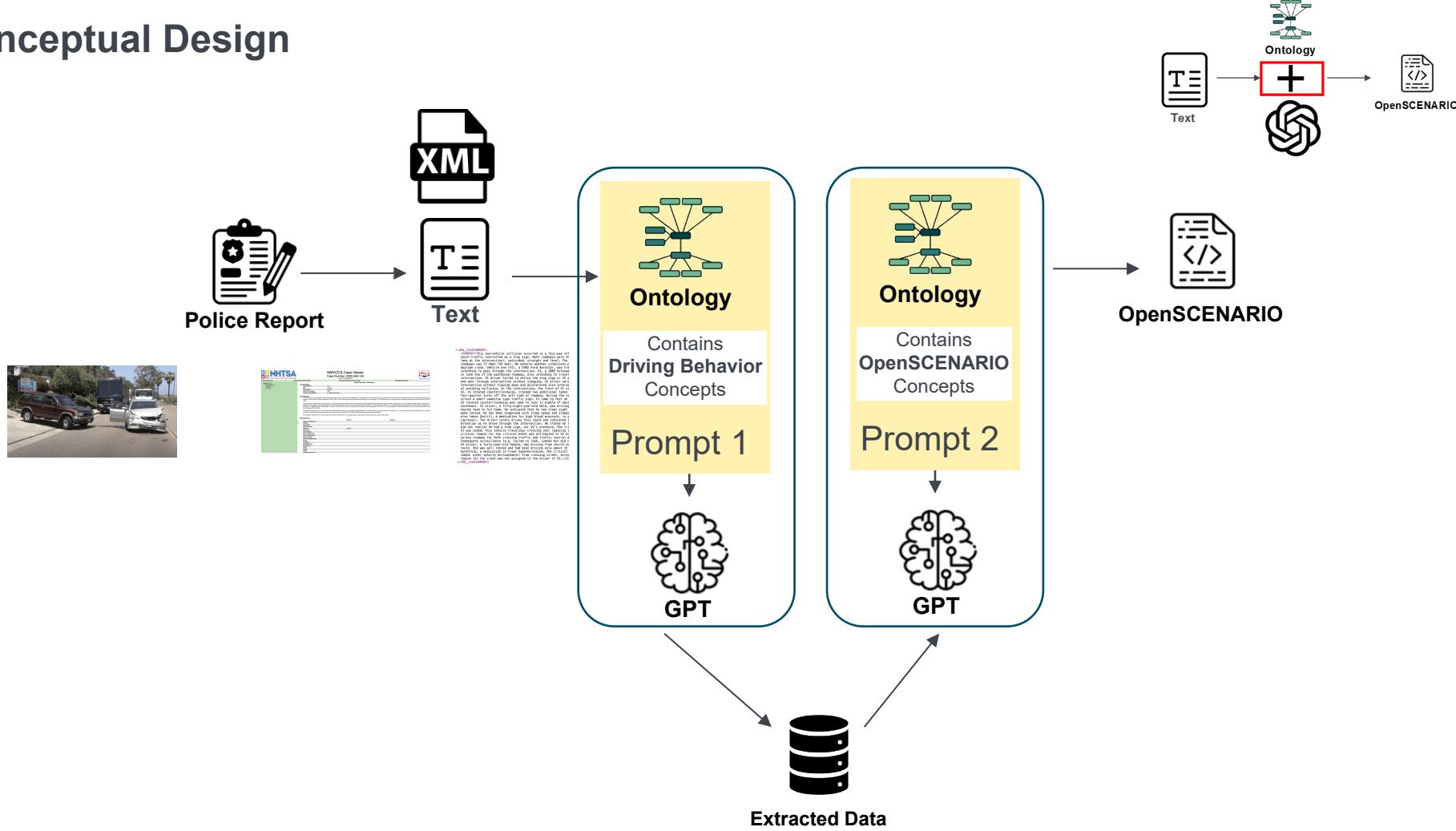


Conceptual Design



- (1) Design the ontology
- (2) Integration of ontology and LLM

Conceptual Design



- Motivation
- Basis
- Conception Design
- Implementation
- Evaluation and Verification
- Summary and Outlook



Implementation



NMVCCS (2005-2007)

[Q New Search](#)

Search performed with the following criteria:
Crash Criteria Number Vehicles<=2 AND Crash Criteria Number Vehicles>=2 AND Crash Criteria Crash Type='Intersecting Paths (Vehicle Damage)' AND Crash Criteria Crash Criteria='A - Incapacitating injury'

Page: 1 < next >

Cases 1-40 of 81

#	Case String	Vehicle Count	Severity	Case ID
1	2005-002-004	2	A - Incapacitating injury	2005002229042
2	2005-003-017	2	A - Incapacitating injury	2005003588301
3	2005-005-035	2	A - Incapacitating injury	2005005289462
4	2005-009-003	2	A - Incapacitating injury	2005009276021
5	2005-011-076	2	A - Incapacitating injury	2005011269063
6	2005-013-042			
7	2005-013-017			
8	2005-043-053			
9	2005-045-112			
10	2005-048-016			
11	2005-048-005			
12	2005-048-052			



NMVCCS Case Viewer
Case Number: 2005-049-142

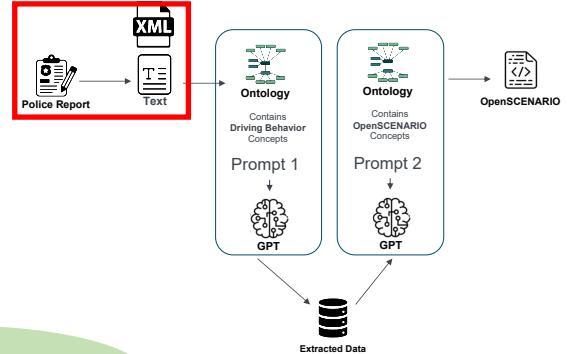
Print Friendly Version of Case

Print Friendly Version of Current View

XML Source

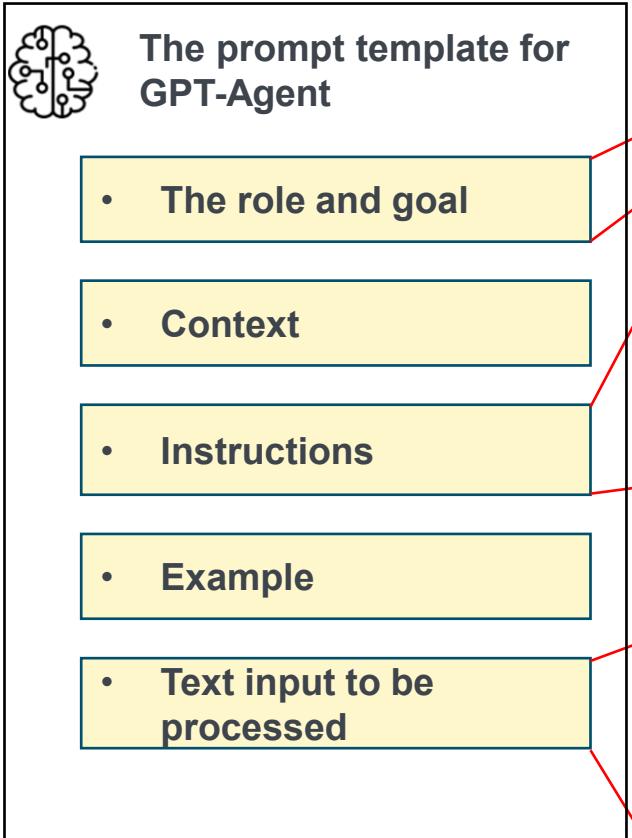
<XML_CASESUMMARY>

<SUMMARY>This two-vehicle collision occurred in a four-way int south traffic controlled by a stop sign. Both roadways were th lane at the intersection), undivided, straight and level. The roadways was 72 kmph (45 mph). No adverse weather conditions p daytime crash. Vehicle one (V1), a 1992 Ford Aerostar, was tra intending to pass through the intersection. V2, a 2005 Volkswa in lane one of the eastbound roadway, also intending to travel intersection. V1 driver failed to notice the stop sign or V2 a and went through intersection without stopping. V2 driver noti intersection without slowing down and accelerated into interse of avoiding collision. In the intersection, the front of V1 st V2. V1 rotated counterclockwise, crossed two additional lanes four-quarter turns off the left side of roadway. During the ro struck a small sawhorse type traffic sign. V1 came to rest on V2 rotated counterclockwise and came to rest in middle of east southeast. V1 driver, a fifty-eight-year-old male, was driving nearby town to his home. He indicated that he had slept eight woke rested. He has been diagnosed with sleep apnea and sleeps also takes Zestril, a medication for high blood pressure, in a Lopressor. The driver rarely drives this route and indicated t attention as he drove through the intersection. He stated he l did not realize he had a stop sign, nor V2's presence. The cri V1 was coded: this vehicle traveling/ crossing over (passing t critical reason for the critical event was attributed to V1 dr survey roadway for both crossing traffic and traffic control d Inadequate surveillance (e.g. failed to look, looked but did n V2 driver, a forty-year-old female, was driving from church to route. She was well rested and had been driving only about 15 Synthroid, a medication to treat hypothyroidism. The critical coded: other vehicle encroachment/ from crossing street, acros reason for the crash was not assigned to the driver of V2.</SU</XML_CASESUMMARY>



Implementation

Structured prompt



Prompt 1

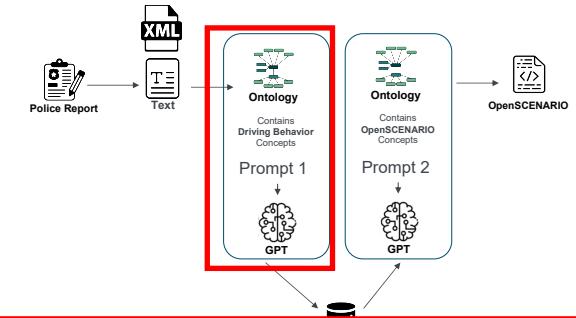
Role and goal:
You are a data extractor to extract information from the input text. Your goal is to extract the process of the collision.
You should consider the provided context, instructions, and example.

Context:
The input data come from a crash report.

Instructions:
As information extractor, please read the crash report carefully and extract the following information:
The trajectory of each vehicle: initial location, collision location, stop location.
The behavior of each vehicle, match the driving behavior ONLY based on the given range: collision, driving straight, lane change, turn, turn back, stop, reversing, acceleration, deceleration and maintain speed.
For extracting these behaviors, refer to the provided definitions of these behaviors:
Driving straight: The act of operating a vehicle in a straight line, maintaining a constant course in a single lane.
Lane change: The act of moving a vehicle from one lane to another on a multi-lane road, typically executed to overtake another vehicle. At the end of the event, the vehicle should be in the neighboring lane.
Turn: The act of changing the direction of a vehicle by rotating its wheels, typically either to the left or to the right.
Turn back: The act of making a 180-degree turn to reverse the direction of travel.
Stop: The act of bringing a vehicle to a complete halt, usually by applying the brakes.
Reversing: The act of operating a vehicle in a direction opposite to its normal forward movement, often achieved by putting the vehicle in reverse gear.
Acceleration: The act of increasing the speed of a vehicle by applying pressure to the accelerator.
Deceleration: The act of reducing the speed of a vehicle, usually by releasing the accelerator or applying the brakes.
Maintain speed: The act of keeping a vehicle moving at a constant speed, typically by using cruise control or consistent pressure on the accelerator.
From the beginning until the two cars stop, the whole process is divided into 3 to 5 behaviors in chronological order.
Only use the input data that are given.
Only output the desired format.

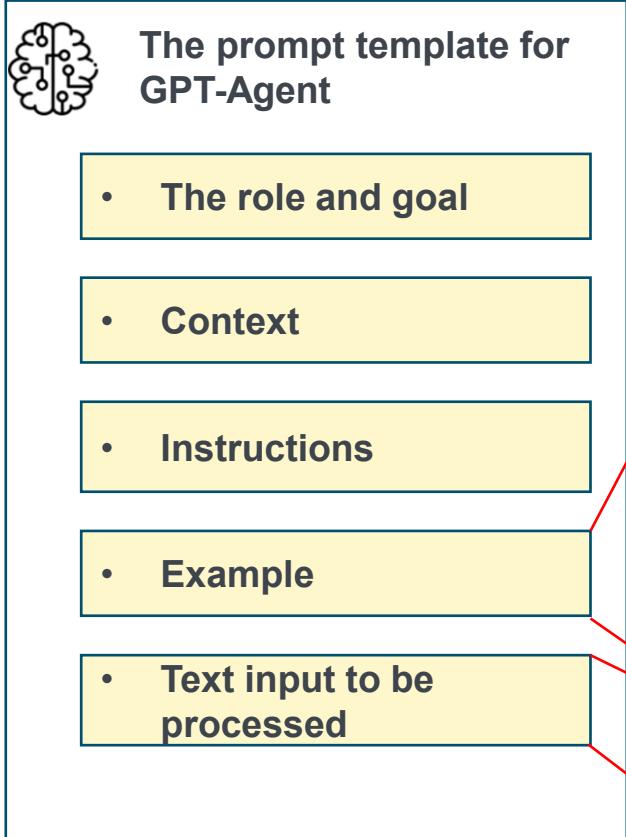
Example:
Input: //
Output:
V1: name
trajectory:initial location, collision location, stop location.
behavior: behavior1, behavior2, behavior3...
V2: name
trajectory: initial location, collision location, stop location.
behavior: behavior1, behavior2, behavior3...

Text input
Input: {This two-vehicle collision occurred in a four-way intersection with north and south traffic controlled by a stop sign. Both roadways were three-lane (with a left turn lane at the intersection), undivided, straight and level. The speed limit on both roadways was 72 kmph (45 mph). No adverse weather conditions present at the time of this daytime crash. Vehicle one (V1), a 1992 Ford Aerostar, was traveling south in lane one intending to pass through the intersection. V2, a 2005 Volkswagen Touareg, was traveling in lane one of the eastbound roadway, also intending to travel straight through the intersection. V1 driver failed to notice the stop sign or V2 approaching from the right and went through intersection without stopping. V2 driver noticed V1 approaching intersection without slowing down and accelerated into intersection with the intention of avoiding collision. In the intersection, the front of V1 struck the back left side of V2. V1 rotated counterclockwise, crossed two additional lanes of traffic and rolled over four-quarter turns off the left side of roadway. During the rollover, the right side struck a small sawhorse type traffic sign. V1 came to rest on the roadside facing north. V2 rotated counterclockwise and came to rest in middle of eastbound traffic lanes facing southeast. V1 driver, a fifty-eight-year-old male, was driving from a toy show in a nearby town to his home. He indicated that he had slept eight hours the night before and woke rested. He has been diagnosed with sleep apnea and sleeps with a CPAP machine. He also takes Zestril, a medication for high blood pressure, in addition to Flomax and Lopressor. The driver rarely drives this route and indicated that he was not paying attention as he drove through the intersection. He stated he looked straight ahead and did not realize he had a stop sign, nor V2's presence. The critical precrash event for V1 was coded: this vehicle traveling/ crossing over (passing through) intersection. The critical reason for the critical event was attributed to vehicle failing to adequately survey roadway for both crossing traffic and traffic control devices. This was coded as: Inadequate surveillance (e.g. failed to look, looked but did not see) for this driver. V2 driver, a forty-year-old female, was driving from church to home, a very familiar route. She was well rested and had been driving only about 15 minutes. She takes Synthroid, a medication to treat hypothyroidism. The critical precrash event for V2 was coded: other vehicle encroachment/ from crossing street, across path. The critical reason for the crash was not assigned to the driver of V2.}
Output:

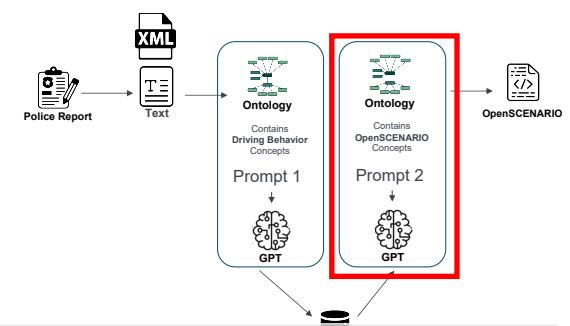


Implementation

Structured prompt



Prompt 2



Role and goal:
You're an OpenSCENARIO XML file generator. Using the input data provided, your task is to produce a OpenSCENARIO XML scenario.

Context:
The given information are behaviors of vehicles. These behaviors describe how the vehicles act within the collision.

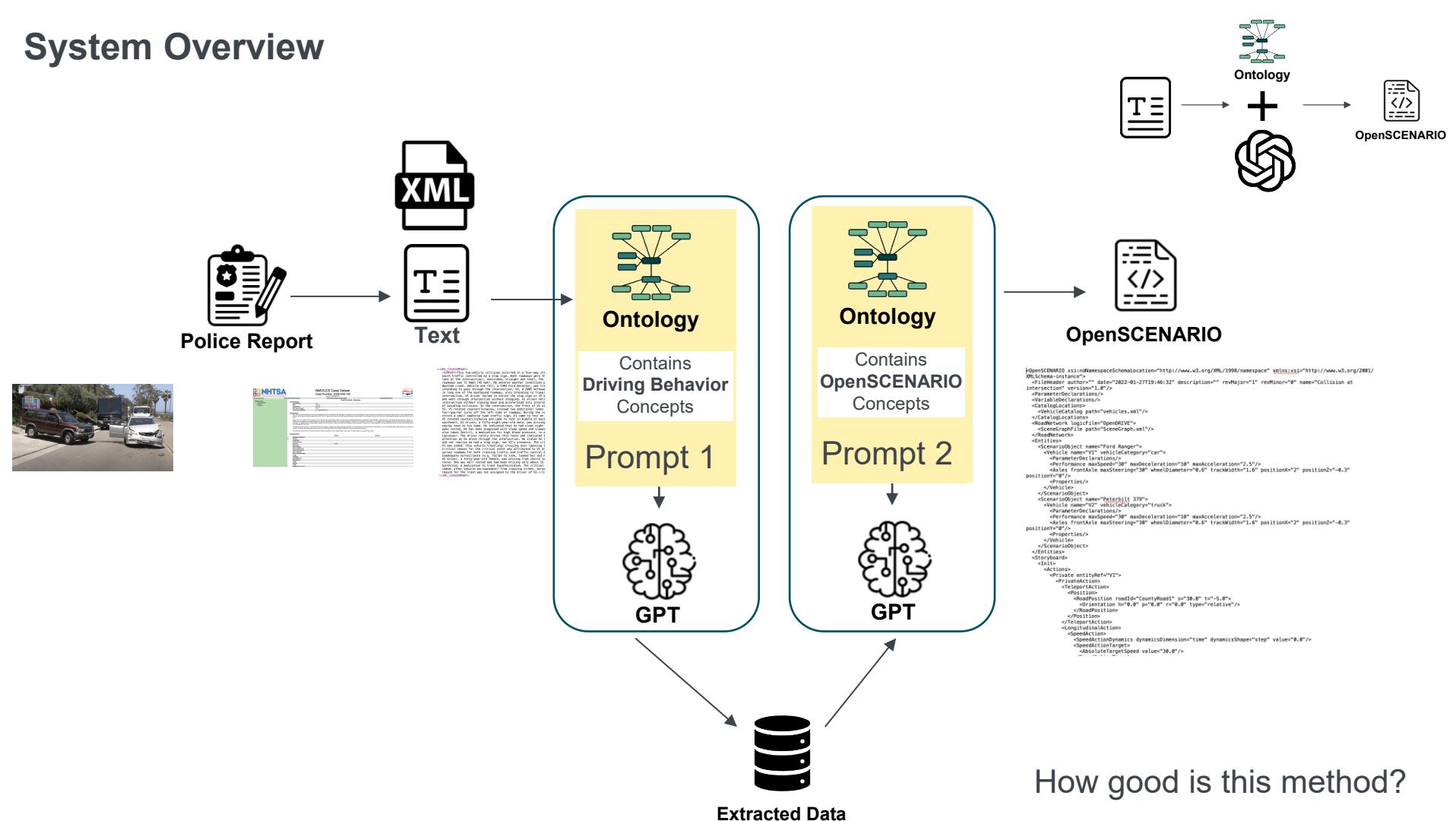
Instructions:
Create a COMPLETE OpenSCENARIO XML from the provided input.
The OpenSCENARIO file should include Fileheader, ParameterDeclaration, VariableDeclarations, CatalogLocations, RoadNetwork, Entities, and Storyboard.
Use the input data exclusively and in the order, they are provided.
Ensure that the storyboard is detailed and comprehensive, every behavior of a vehicle corresponds to an event.
You can make up any details not provided, such as distances, speeds, and trigger conditions.
use the Schema References:<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema">
<xsd:import namespace="http://www.w3.org/XML/1998/namespace" schemaLocation="http://www.w3.org/2001/xml.xsd"/>

Example:
Input: V2 driving straight, V1 turn left, when relative distance falls below 20 m, V1 starts its left LaneChange action to the left.
Output:
<Event priority="overwrite" maximumExecutionCount="1" name="Turn left">
 <Action name="Lane Change">
 <PrivateAction>
 <LaneChangeAction>
 <LaneChangeActionOffset>0.0238800048828</LaneChangeActionOffset>
 <LaneChangeActionDynamics dynamicsDimension="distance" dynamicsShape="cubic" value="36.6430664063"/>
 <LaneChangeTarget>
 <AbsoluteTargetLane value="-3"/>
 </LaneChangeTarget>
 </LaneChangeAction>
 </PrivateAction>
 </Action>
 <StartTrigger>
 <ConditionGroup>
 <Condition delay="0.0" conditionEdge="rising" name="Relative Distance">
 <ByEntityCondition>
 <TriggeringEntities triggeringEntitiesRule="any">
 <EntityRef entityRef="Vehicle 1"/>
 </TriggeringEntities>
 <InCondition>
 <RelativeDistanceCondition freespace="false" rule="lessThan" entityRef="Vehicle 2" value="20.0" relativeDistanceType="longitudinal"/>
 </InCondition>
 </ByEntityCondition>
 </ConditionGroup>
 </StartTrigger>
 </Event>

```
Input: {
    VV1: 1999 Dodge Intrepid
    behavior: acceleration, collision, maintain speed, stop.

    V2: 1998 GMC Safari Minivan
    behavior: stop, driving straight, collision, maintain speed, stop.
}
Output:
```

System Overview



- Motivation
- Basis
- Conception Design
- Implementation
- **Verification**
- Summary and Outlook



Verification

Comparison of Ontology Integration in Behavior Identification

Information extraction with ontology	Information extraction without ontology
<p>V1: 1999 Ford Ranger Behavior: stop, driving straight, collision, stop</p>	<p>V1: 1999 Ford Ranger Behavior: traveling southbound, attempting to cross the intersection, impacted by V2, departed towards southeast of the intersection, impacted with a telephone guy wire.</p>
<p>V2: 1992 Peterbilt Conventional 379 tractor Behavior: driving straight, collision, stop</p>	<p>V2: 1992 Peterbilt Conventional 379 Behavior: traveling eastbound in the second lane, observed V1 stationary, impacted the right side of V1, departed the left side of the road, rested northeast of the intersection.</p>

- Concise, Structured
- Mapping to predefined ontology elements

Uncontrolled generation (non-deterministic)

Not compliant with OpenSCENARIO

→ Hallucination

→ Even though with more texts

Verification

10 traffic accident reports

comparison	Required information elements	Information elements generated	correct generated elements	Generation Rate	Information Element Correctness
without ontology	30(for each)	6.3	2.4	0.21	0.08
with ontology	30(for each)	16.8	13.8	0.56	0.46

- Motivation
- Basis
- Fundamental Ontology Creation
- Conception Design
- Implementation
- Evaluation and Verification
- **Summary and Outlook**



Summary and Outlook

Summary:

- Combining ontology with LLMs enhance behavior identification from crash reports
- With ontology get a higher generation rate in OpenSCENARIO

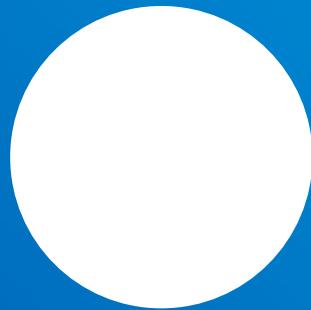
Outlook:

- Validation Test the file in simulation environment.
- Include more data sources to satisfy the required information by OpenSCENARIO files.
- Whether the model really "understand" the scenario (the model of dynamics)? Or mimic the pattern in text-data?



University of Stuttgart
Institut of Industrial Automation
and Software Engineering

Thank you!



Sijia Chen

e-mail st176741@stud.uni-stuttgart.de

phone +49 (0) 711 685-

fax +49 (0) 711 685-

University of Stuttgart



Quelle

- <https://www.gamearter.com/blog/bmw-autonomous-driving-development>
- <https://www.audi.com/en/innovation/future-technology/autonomous-driving/driverless-test-drives-in-china.html>
- <https://thelowdown.momentum.asia/the-emergence-of-large-language-models-langs/>
- <https://arxiv.org/pdf/1706.03762.pdf>

- <https://www.ontotext.com/knowledgehub/fundamentals/what-are-ontologies/>

Implementation

How system works?

Role and goal:

You are a data extractor to extract information from the input text. Your goal is to extract the process of the collision. You should consider the provided context, instructions, and example.

Context:

The input data come from a crash report.

Instructions:

As information extractor, please read the crash report carefully and extract the following information:

The trajectory of each vehicle: initial location, collision location, stop location.

The behavior of each vehicle, match the driving behavior ONLY based on the given range: collision, driving straight, turn, turn back, stop, reversing, acceleration, deceleration and maintain speed.

For extracting these behaviors, refer to the provided definitions of these behaviors:

Driving straight: The act of operating a vehicle in a straight line, maintaining a constant course in a single lane.

Lane change: The act of moving a vehicle from one lane to another on a multi-lane road, typically executed to overtake a vehicle. At the end of the event, the vehicle should be in the neighboring lane.

Turn: The act of changing the direction of a vehicle by rotating its wheels, typically either to the left or to the right.

Turn back: The act of making a 180-degree turn to reverse the direction of travel.

Stop: The act of bringing a vehicle to a complete halt, usually by applying the brakes.

Reversing: The act of operating a vehicle in a direction opposite to its normal forward movement, often achieved by a vehicle in reverse gear.

Acceleration: The act of increasing the speed of a vehicle by applying pressure to the accelerator.

Deceleration: The act of reducing the speed of a vehicle, usually by releasing the accelerator or applying the brakes.

Maintain speed: The act of keeping a vehicle moving at a constant speed, typically by using cruise control or constantly applying the accelerator.

From the beginning until the two cars stop, the whole process is divided into 3 to 5 behaviors in chronological order.

Only use the input data that are given.

Only output the desired format.

Example:

Input: //

Output:

V1: name

trajectory:initial location, collision location, stop location.

behavior: behavior1, behavior2, behavior3...

V2: name

trajectory: initial location, collision location, stop location.

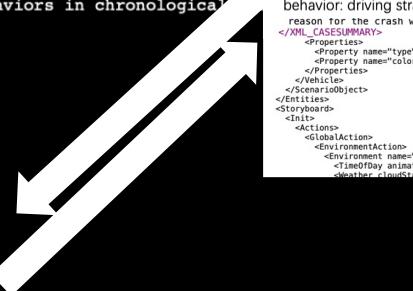
behavior: behavior1, behavior2, behavior3...

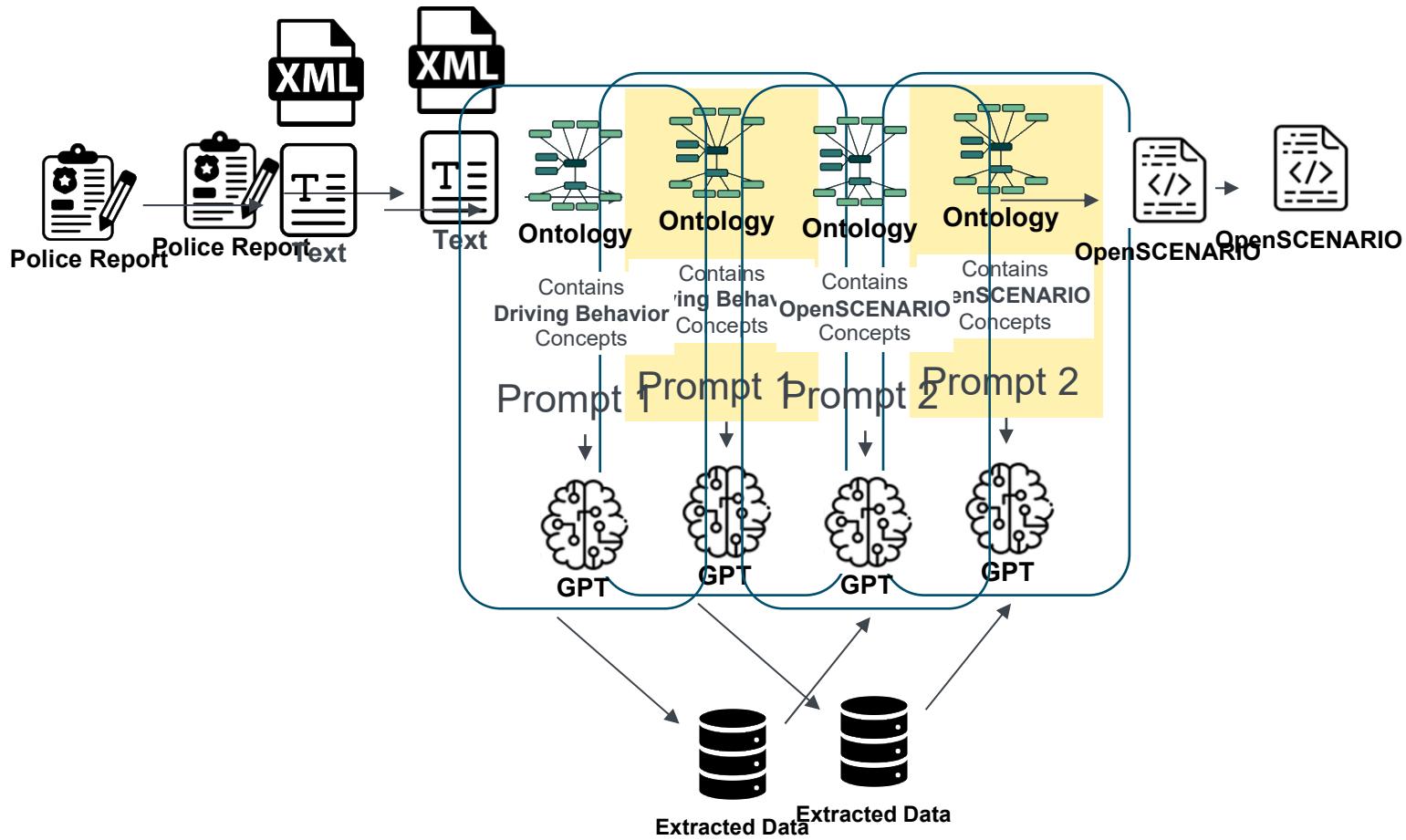
Input: {extracted_text}

Output:

```
<?xml version="1.0" encoding="UTF-8"?>
<OpenSCENARIO>
  <FileVersion major="1" revMinor="0" date="2020-03-20T12:00:00" description="CARLA:FollowLeadingVehicle" author="" />
  <ParameterDeclarations>
    <!-- LANE PLANT -->
    <SUMMARY>
      A two-vehicle collision occurred in a four-way intersection with north and south traffic controlled by a stop sign. Both roadways were three-lane (with a left turn lane at the intersection), undivided, straight and level. The speed limit on both roadways was 72 kmph (45 mph). No adverse weather conditions present at the time of this nighttime crash. Vehicle V1 (V1) a 1999 Ford Expedition was traveling south in lane one intending to pass through the intersection. A 2005 Dodge Ram truck (V2) was traveling in lane one of the eastbound roadway, also intending to travel straight through the intersection. V1 driver failed to notice the stop sign or V2 approaching from the right and went through intersection without stopping. V2 driver noticed V1 approaching intersection with a slow down and accelerated into intersection with the intention of avoiding collision. In the intersection, V1 hit V2 on the back-left side of V2. V1 rotated counterclockwise, crossed two additional lanes of traffic and rolled over four-quarter turns off the left side of roadway. During the roll-over, the right side struck a small tree and the front of the vehicle struck a concrete barrier, coming to a stop facing north. V2 driver, a fifty-eight-year-old male, was driving from a toy shop in a nearby town to his home. He indicated that he had slept eight hours the night before and was rested. He has been diagnosed with cleft lip and cleft palate with a CPAP machine. He V1: 1999 Ford Expedition
      V2: 2001 Dodge Ram 1500 truck
    </SUMMARY>
    <Properties>
      <Property name="type" value="simulation"/>
      <Property name="color" value="255,0,0"/>
    </Properties>
    <ScenarioObject>
      <Entities>
        <Storyline>
          <Act>
            <GlobalAction>
              <EnvironmentActions>
                <Environment name="Environment1">
                  <TimeOfDay anim="false" dateTimed="2020-03-20T12:00:00"/>
                  <WeatherState state="clear" />
                </Environment>
              </EnvironmentActions>
            </GlobalAction>
          </Act>
        </Storyline>
      </Entities>
    </ScenarioObject>
  </ParameterDeclarations>
</OpenSCENARIO>
```

Extracted Data





Conceptual XML design

