Mission Assistant of Marine Robots by Encyclopaedic Roadmap

Mahya Kashani
Supervisor: Prof. Andrzej Wasowski
IT-University of Copenhagen

Problem Statement

Mission:
Oil & Gas Infrastructures Inspection

Challenge

Motivation

But, why?

Review

Challenge

Motivation

Review

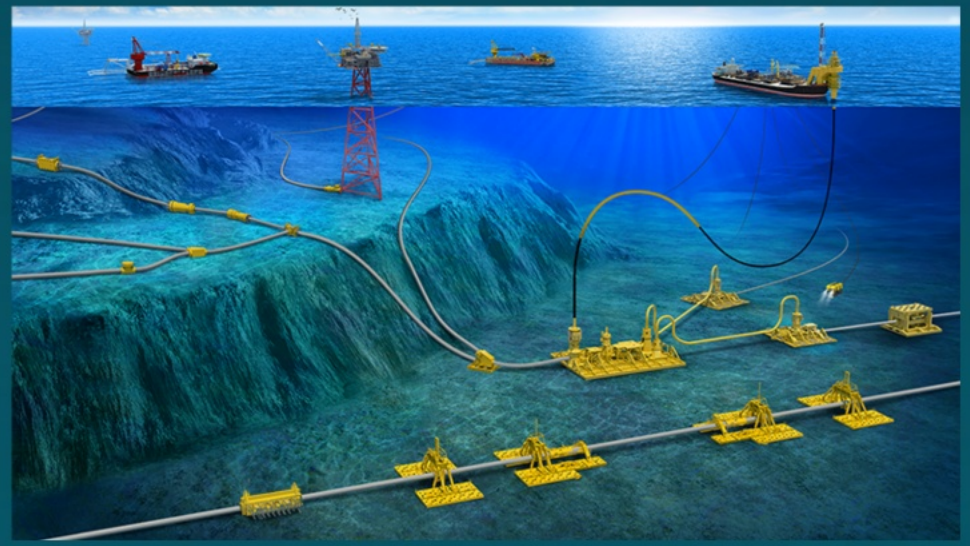
Problem Statement

Mission:
Oil & Gas Infrastructures Inspection

Our Goal:
Assumption-based Plan Generation
in the context of generating scenarios with associated to risks (deviated beliefs)

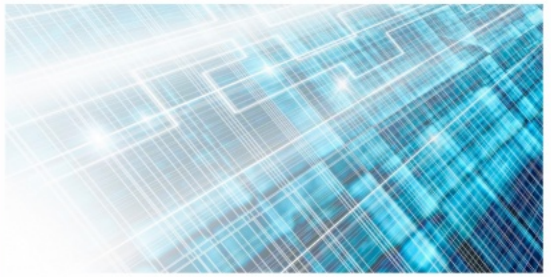
But, why?

Real-world scenario



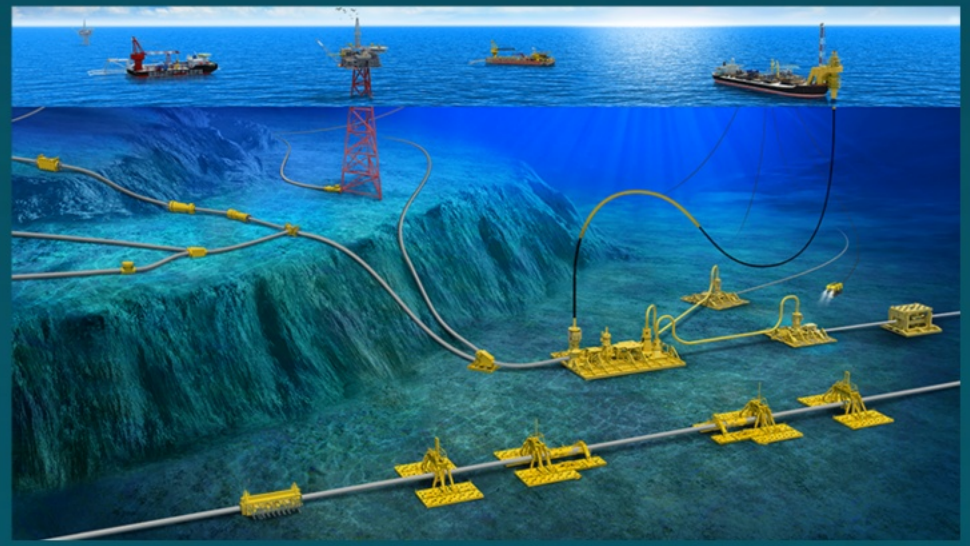
subsea infrastructures

Safety 4.0 project



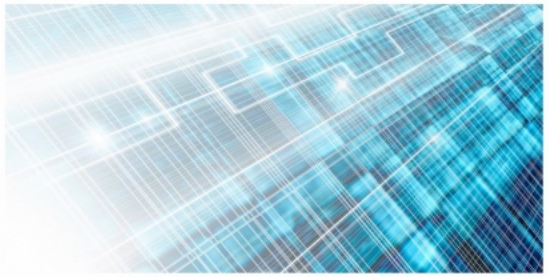
Demonstrating safety of software-dependent systems, with examples from subsea electric technology.

Real-world scenario



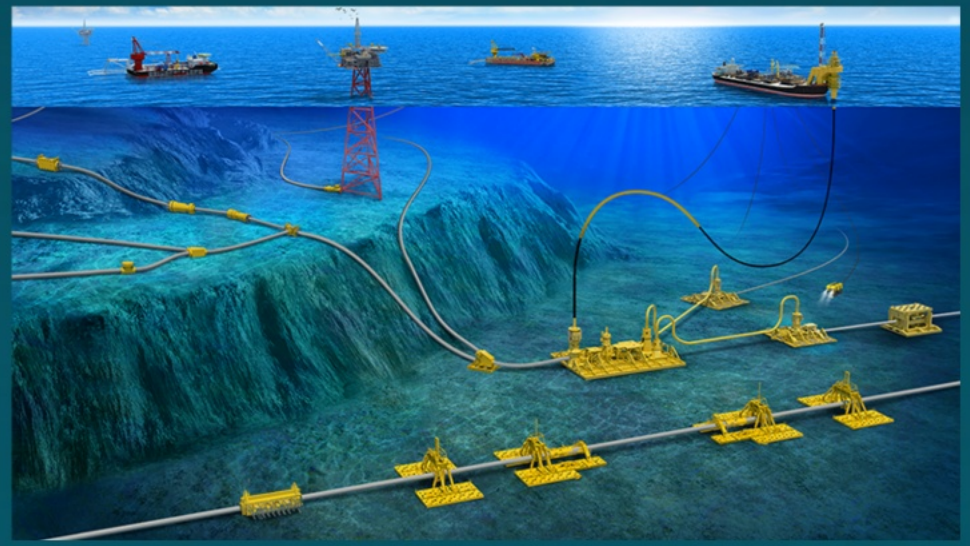
subsea infrastructures
are complex systems

Safety 4.0 project



Demonstrating safety of software-dependent systems, with examples from subsea electric technology.

Real-world scenario

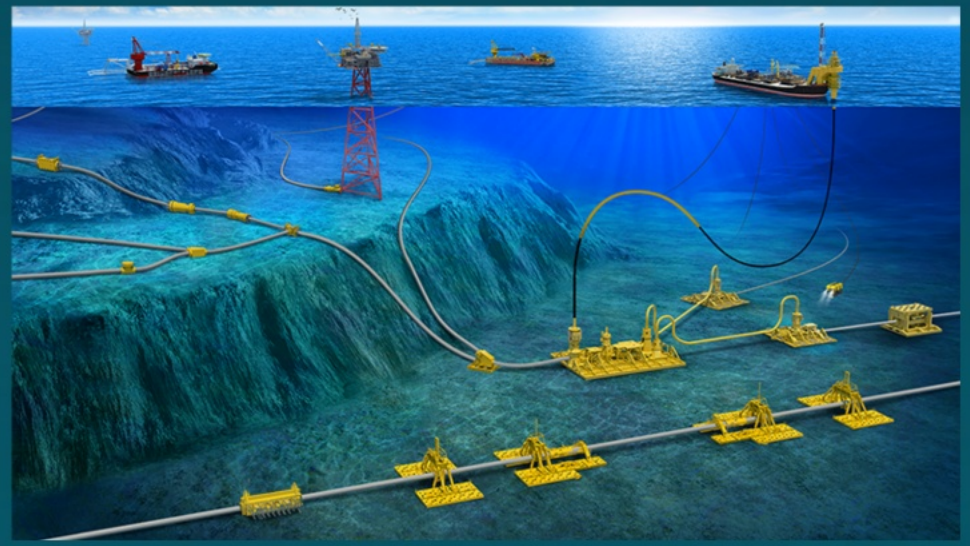


subsea infrastructures

are complex systems

analysing behavior of its system requires considering different level of abstractions

Real-world scenario



subsea infrastructures

are complex systems

analysing behavior of its system
requires considering different level
of abstractions

with examples
from
subsea electric technology

Challenge

Motivation

Review

Problem Statement

Mission:
Oil & Gas Infrastructures Inspection

Our Goal:
Assumption-based Plan Generation
in the context of generating scenarios with associated to risks (deviated beliefs)

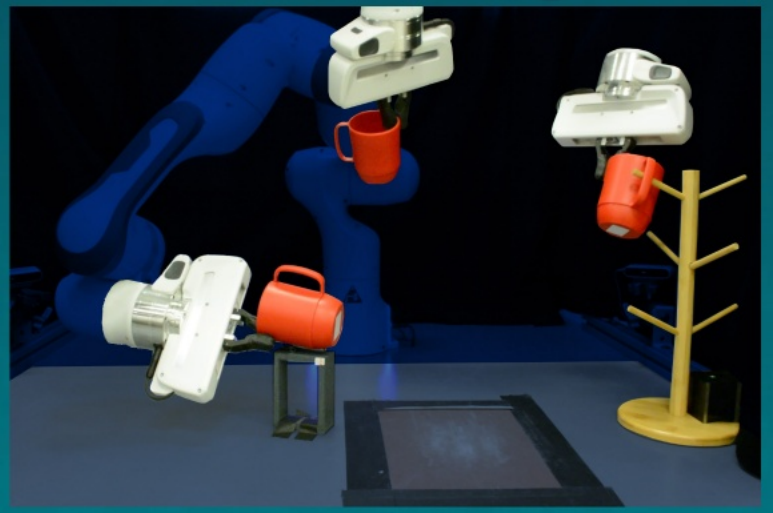
But, why?

blem Statement

Mission:
Oil & Gas Infrastructures Inspection

Our Goal:
Assumption-based Plan Generation
in the context of generating scenarios with

Limitation of Current Automated Systems Evaluation



Task Planning

Knowledge Representation

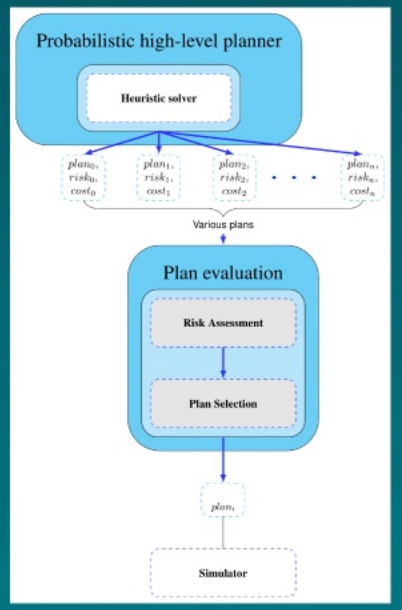
An example of high-level task planning in PDDL form

```
(:action waypoint-following
    :parameters (
        ?auv - robot
        ?from - waypoint
        ?to - waypoint
        ?sonar1 - sonar1
        ?sonar0 - sonar0
    )
    :precondition (and
        (at ?auv ?from)
        (not (outOfRangeSonar1 SSSsonar1))
    )
    :effect (and
        (when (not (ObjectAvoidanceFailure1 ?from ?to)) (and
            (not (at ?auv ?from))    ; move from first to second waypoint
            (at ?auv ?to)
            )
        )
        ; on risky paths, sonar sensor cannot work functionality
        ; there is no difference between two sonar sensors
        (probabilistic
            0.95 (when (ObjectAvoidanceFailure0 ?from ?to) (outOfRangeSonar0 ?sonar0))
        )
        (probabilistic
            0.95 (when (ObjectAvoidanceFailure1 ?from ?to) (outOfRangeSonar1 ?sonar1))
        )

    )
)
```

Reliable Plan Selection with Quantified Risk-Sensitivity, T. John, M. M. Kashani, J. P. Coffelt, E. B. Johnsen, A. Wąsowski, 34th Nordic Workshop on Programming Theory (NWPT2023)

Risk Probabilistic Assessment (RPA) models are context-independant

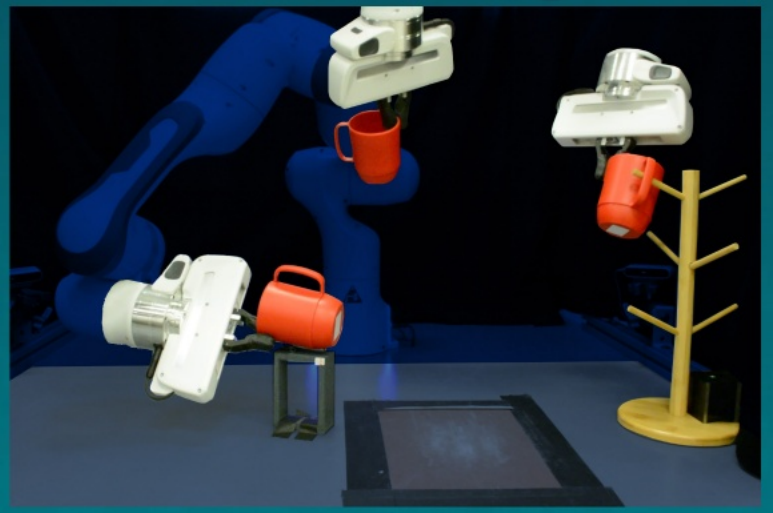


```
(:action waypoint-following
    :parameters (
        ?auv - robot
        ?from - waypoint
        ?to - waypoint
        ?sonar1 - sonar1
        ?sonar0 - sonar0
    )
    :precondition (and
        (at ?auv ?from)
        (not (outOfRangeSonar1 SSSsonar1))
    )
    :effect (and
        (when (not (ObjectAvoidanceFailure1 ?from ?to)) (and
            (not (at ?auv ?from))   ; move from first to second waypoint
            (at ?auv ?to)
            )
        )
        ; on risky paths, sonar sensor cannot work functionality
        ; there is no difference between two sonar sensors
        (probabilistic
            0.95 (when (ObjectAvoidanceFailure0 ?from ?to) (outOfRangeSonar0 ?sonar0))
        )
        (probabilistic
            0.95 (when (ObjectAvoidanceFailure1 ?from ?to) (outOfRangeSonar1 ?sonar1))
        )

    )
)
```

Ris
mo

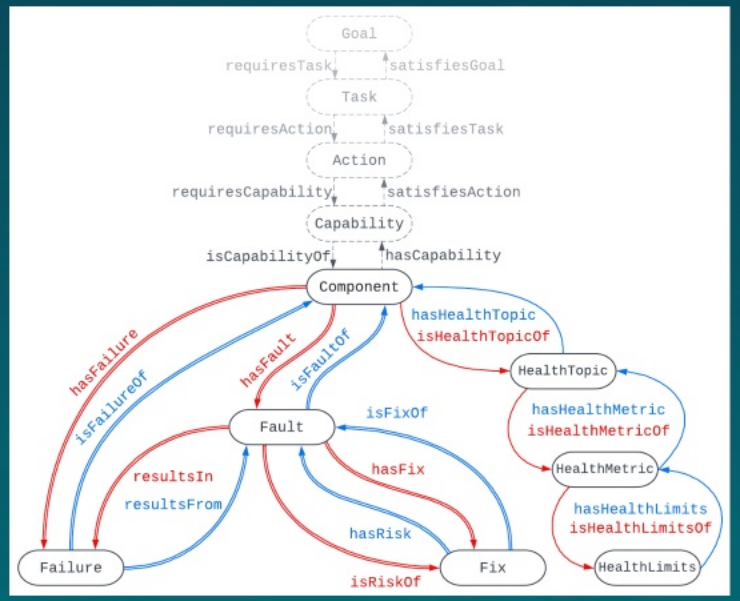
Limitation of Current Automated Systems Evaluation



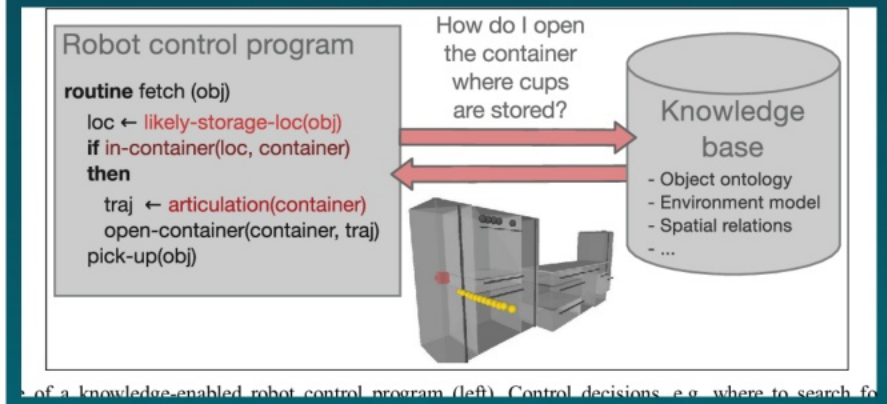
Task Planning

Knowledge Representation

Limitation of current Knowledge Representation



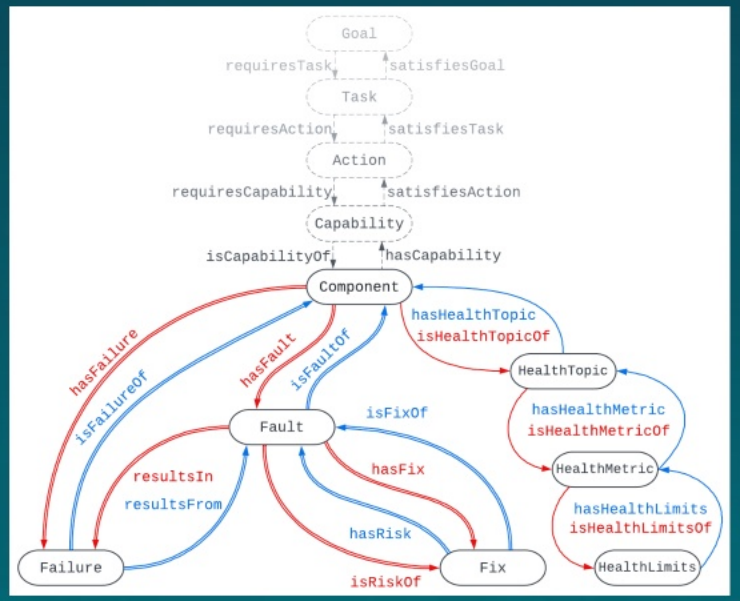
Coffelt, J. P., Kashani, M. M., Wasowski, A., & Kampmann, P. (2022, August). Belief-based fault recovery for marine robotics. In The Eighth Joint Ontology Workshops (JOWO'22), August 15-19, 2022, Jönköping University, Sweden (pp. paper3-RobOntics).



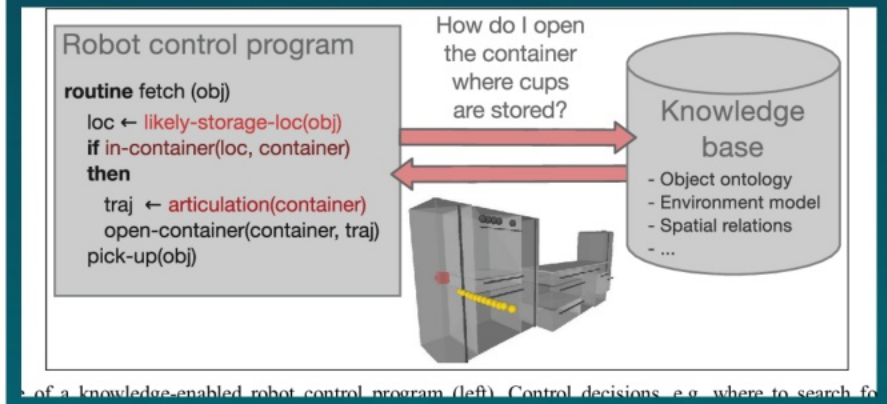
of a knowledge-enabled robot control program (left). Control decisions, e.g., where to search fo

Structured data

Limitation of current Knowledge Representation



Coffelt, J. P., Kashani, M. M., Wasowski, A., & Kampmann, P. (2022, August). Belief-based fault recovery for marine robotics. In The Eighth Joint Ontology Workshops (JOWO'22), August 15-19, 2022, Jönköping University, Sweden (pp. paper3-RobOntics).

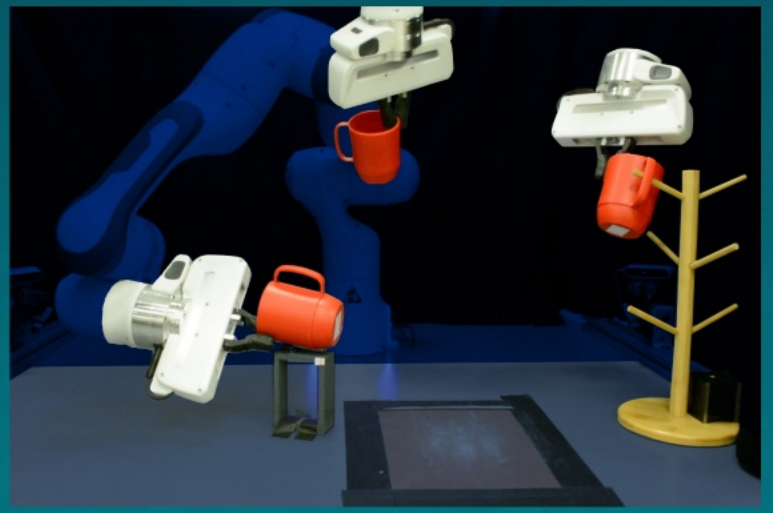


of a knowledge-enabled robot control program (left). Control decisions, e.g., where to search fo

KB made upon expert people's opinion

Structured data

Limitation of Current Automated Systems Evaluation



Task Planning

Knowledge Representation

Challenge

Motivation

Review

Problem Statement

Mission:
Oil & Gas Infrastructures Inspection

Our Goal:
Assumption-based Plan Generation
in the context of generating scenarios with associated to risks (deviated beliefs)

But, why?

Mission:
Oil & Gas Infrastructures Inspection

Our Goal:
Assumption-based Plan Generation
in the context of generating scenarios with
associated to risks (deviated beliefs)

, why?

R

Previous Aproach

Review risk assessment

assumption-based planning

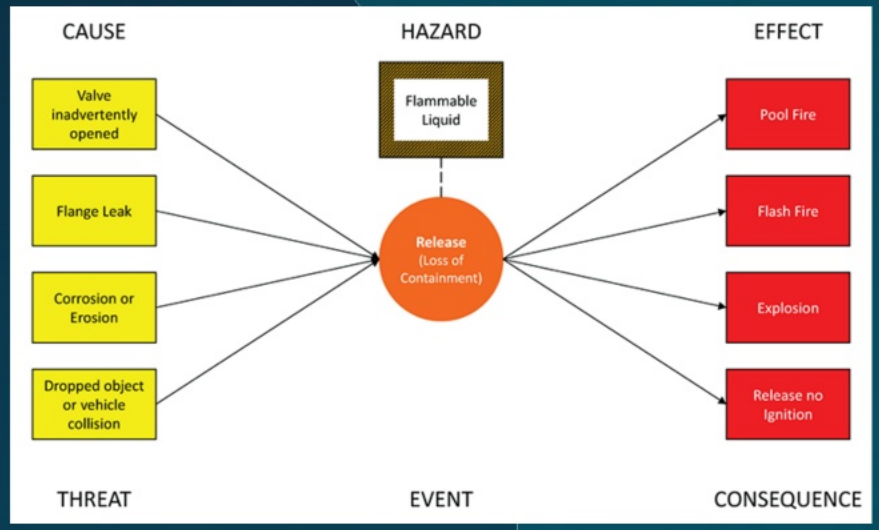
Risk assessment classifies in 3 categories

General mission, Maintenance, Inspection, & Repair (MIR)

Qualitative approaches

General guidelines, risk management using non-probabilistic models with expert knowledge

Ex: Safety Measure Analysis (2000, 2007), Fault Response Table, Grey Relation Analysis(2015), **Bow-tie** (2017)



Use in specific problem

Semi-quantitative approaches

quantify probabilities and consequences in an approximate way

Ex: **FTA**, ETA, Risk Management Process (RMP) , Failure Mode and Effect Analysis (FMEA), Monte Carlo Simulation, Kaplan-Meier Survival Model, Weibull analysis

Quantitative approaches

BBN, **MDP, MC**, Probability Tree Model, HPA-Star Algorithm

A Review of Risk Analysis Research for the Operation of Autonomous Underwater Vehicles (AUVs)", Xi Chen, Mario P. Borito, et al, *Journal of Safety and Reliability Engineering, 2021*

Use in specific problem

General mission, Maintenence, Inspection, & Repair (MIR)

em

Qualita

RI

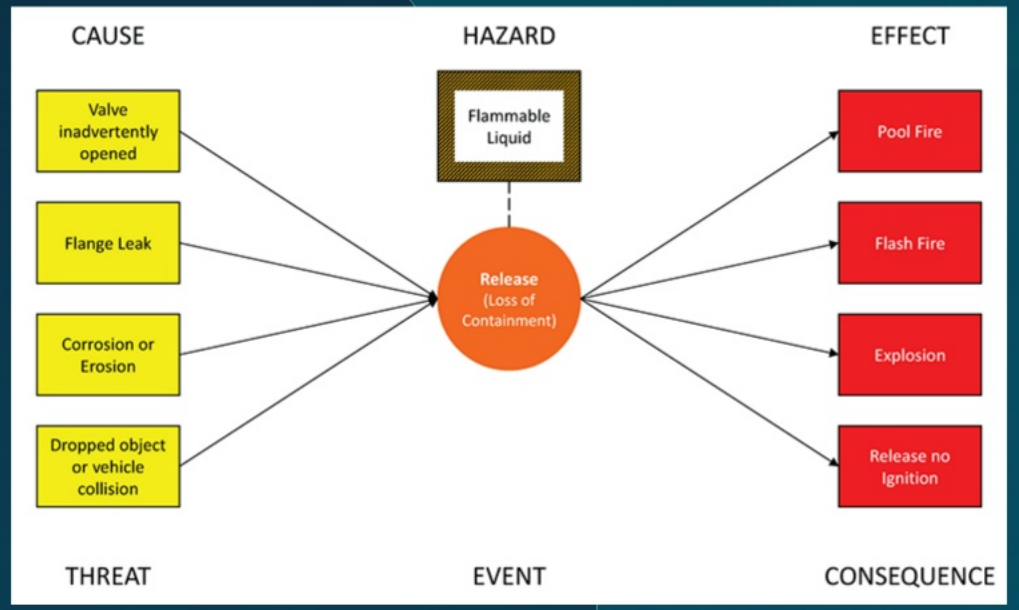
General mission, Maintenence, Inspection, & Repair (MIR)

Risk assessment classifies in 3 categories

Qualitative approaches

General guidelines, risk management using non-probabilistic models with expert knowledge

Ex: Safety Measure Analysis (2000, 2007), Fault Response Table, Grey Relation Analysis(2015), **Bow-tie** (2017)



Semi-quantitative approaches

quantify probabilities and consequences in an approximate way

Ex: **FTA**, ETA, Risk Management Process (RMP) , Failure Mode and Effect Analysis (FMEA), Monte Carlo Simulation, Kaplan-Meier Survival Model, Weibull analysis

cific problem

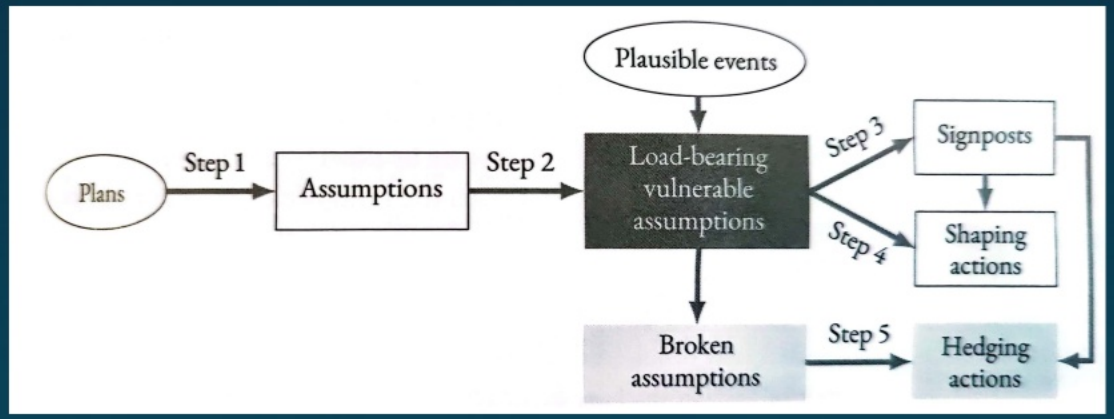
Quantitative approaches

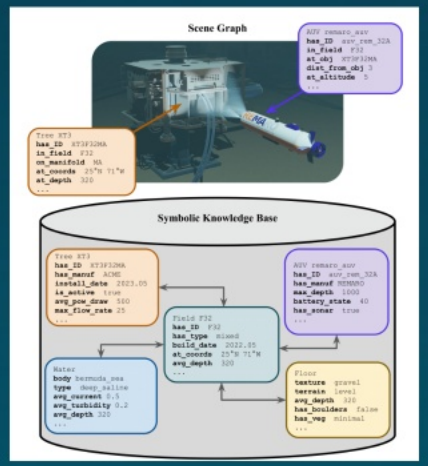
Previous Aproach

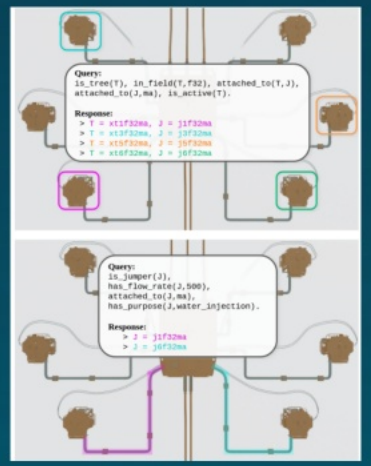
Review risk assessment

assumption-based planning

Assumption-based Planning







Odonkor, D., Coffelt, J. P., Syrbe, J., & Beetz, M. Towards a Semantic Digital Twin for Marine Robotics.

Previous Aproach

Review risk assessment

assumption-based planning

Challenge

Motivation

Review

Problem Statement

Mission:
Oil & Gas Infrastructures Inspection

Our Goal:
Assumption-based Plan Generation
in the context of generating scenarios with associated to risks (deviated beliefs)

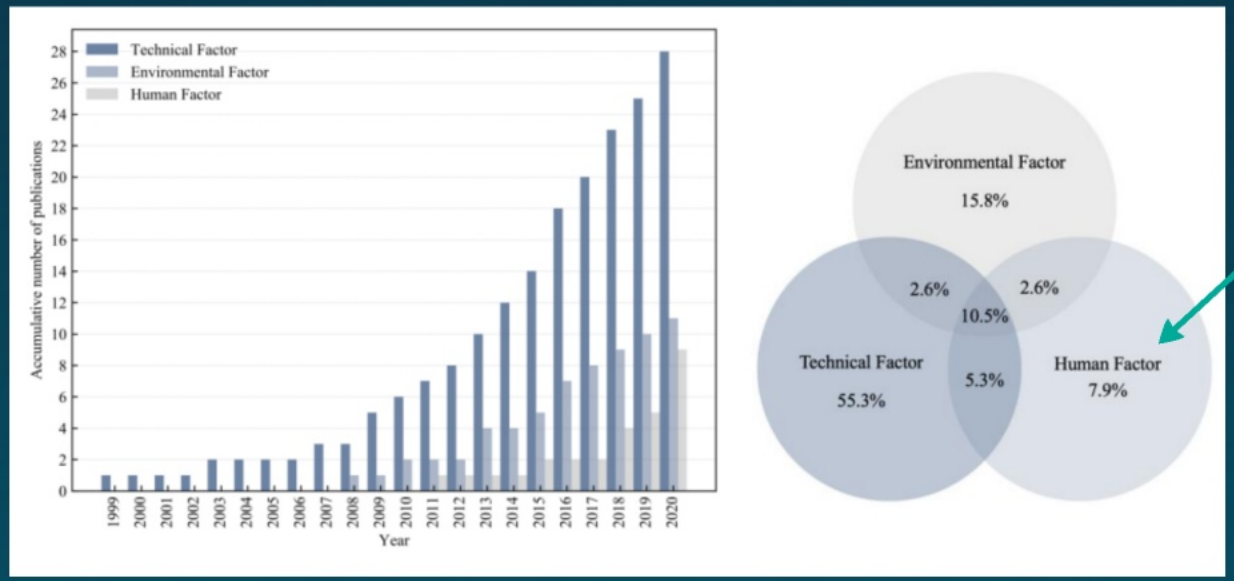
But, why?

But, why Mission Assistant?

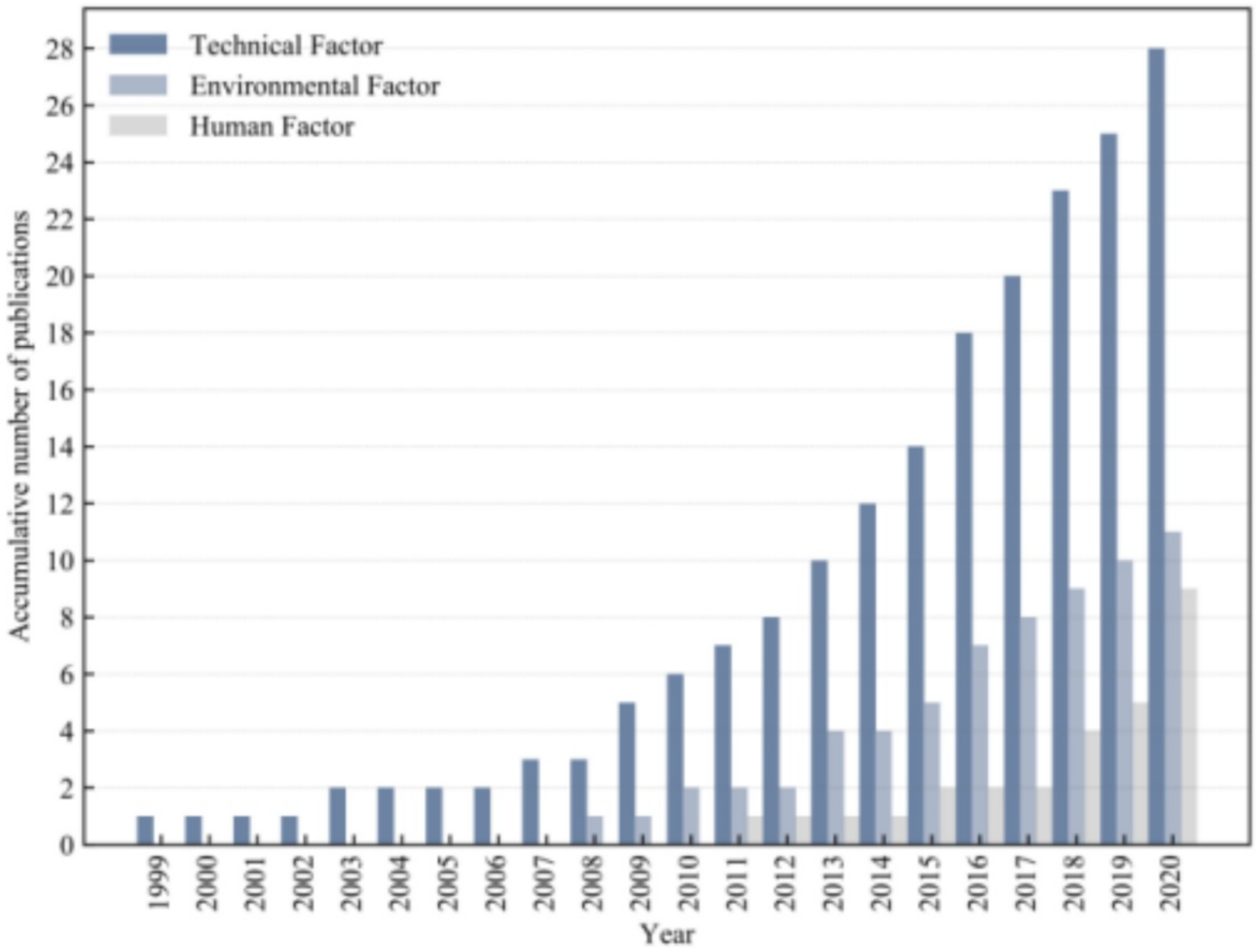
Why Conversational AI Frameworks?

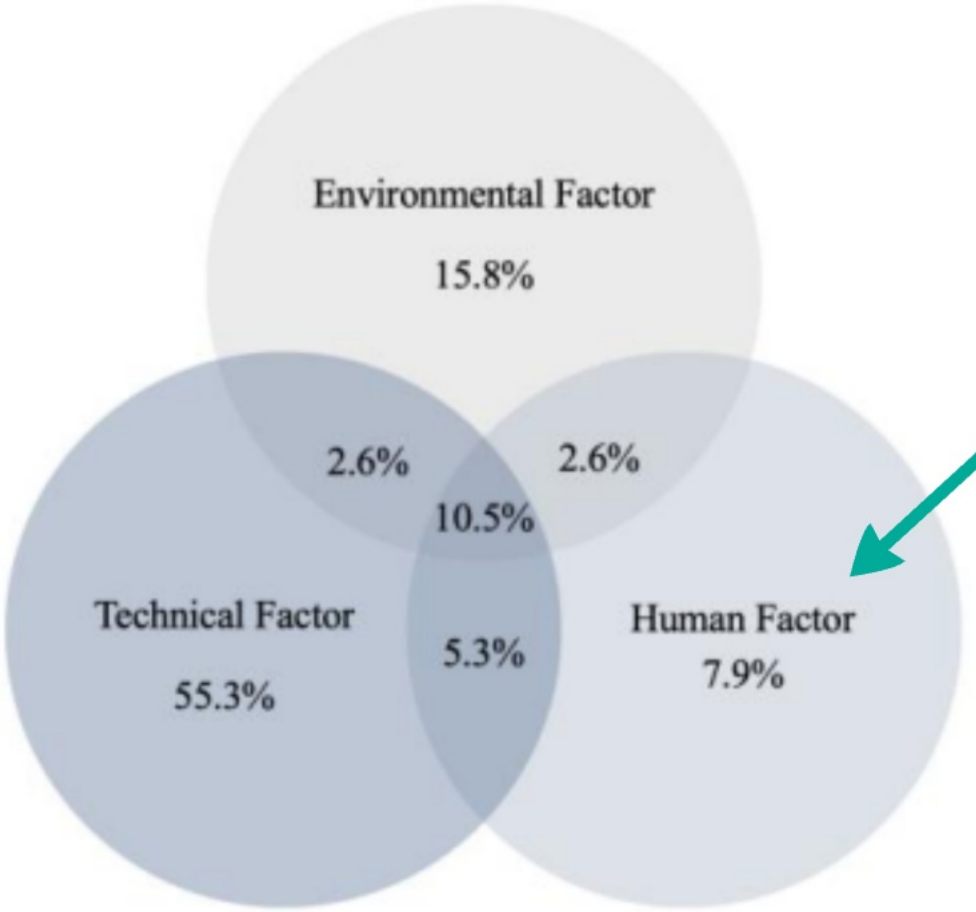
Risk Identification

Risk Identification



3 main risk factors had been studied in research papers



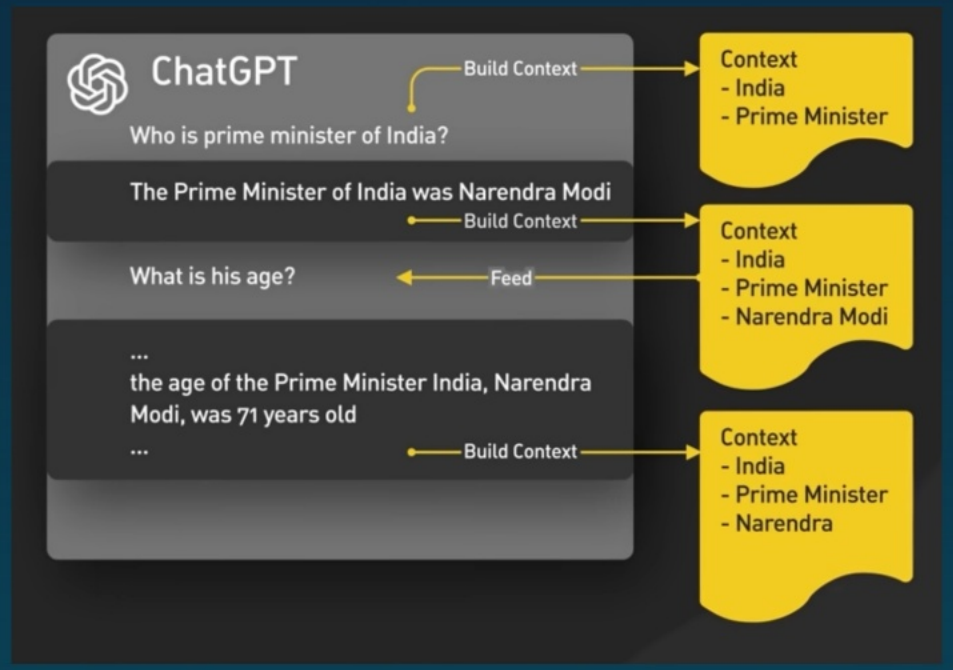


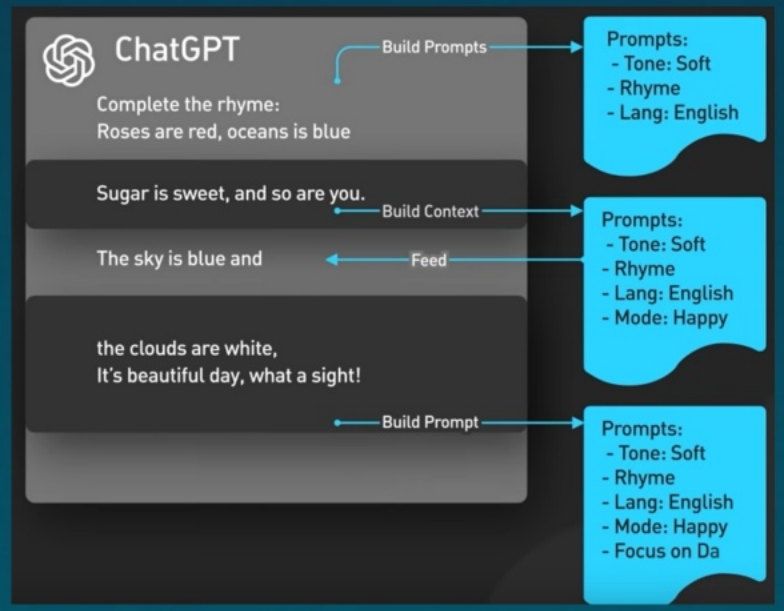
2 main risk factors had been studied in research papers

But, why Mission Assistant?

Why Conversational AI Frameworks?

Risk Identification


ChatGPT
Build Context
Who is prime minister of India?
Context
- India
- Prime Minister
The Prime Minister of India was Narendra Modi
Build Context
What is his age?
Feed
Context
- India
- Prime Minister
- Narendra Modi
...
the age of the Prime Minister India, Narendra Modi, was 71 years old
...
Build Context
Context
- India
- Prime Minister
- Narendra


ChatGPT
Build Prompts
Complete the rhyme:
Roses are red, oceans is blue
Prompts:
- Tone: Soft
- Rhyme
- Lang: English
Sugar is sweet, and so are you.
Build Context
The sky is blue and
Feed
Prompts:
- Tone: Soft
- Rhyme
- Lang: English
- Mode: Happy
the clouds are white,
It's beautiful day, what a sight!
Build Prompt
Prompts:
- Tone: Soft
- Rhyme
- Lang: English
- Mode: Happy
- Focus on Da

But, why Mission Assistant?

Why Conversational AI Frameworks?

Risk Identification

Challenge

Motivation

Review

Problem Statement

Mission:
Oil & Gas Infrastructures Inspection

Our Goal:
Assumption-based Plan Generation
in the context of generating scenarios with associated to risks (deviated beliefs)

But, why?

Mission Assistant of Marine Robots by Encyclopaedic Roadmap

Mahya Kashani
Supervisor: Prof. Andrzej Wasowski
IT-University of Copenhagen

Proposed approach

Objectives

Research Qestions

Research Steps

Objective(s)

Assisting operators and show the results in a human understanding way

Proposed framework

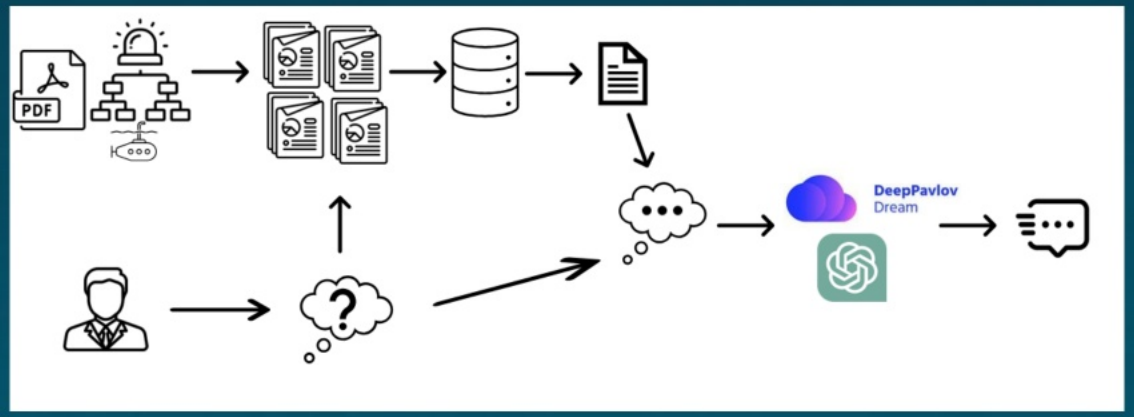
Objective(s)

Proposed framework

Assisting operators and show the results in a human understanding way

Providing chat bot to communiate with operator & shape a desired scenario

Proposed Framework



building a prompt using only relevant information
from our document sources

Objective(s)

Proposed framework

Assisting operators and show the results in a human understanding way

Providing chat bot to communiate with operator & shape a desired scenario

Proposed approach

Objectives

Research Qestions

Research Steps

RQs

RQ1: How Large Language Models (LLMs) can assist marine missions?

RQ2: What is meaningful generative plans/ scenarios using LLMs?

RQ3: What are the possible challenges and limitations of using LLMs to generate plans in terms of reliability?

Proposed approach

Objectives

Research Qestions

Research Steps

Research Steps

- Extracting competence data using Incident Response Plan (IRP) from past successful/ failure ma-
rine missions
- Designing different Natural Language Processing (NLP) tasks, such as Text Classification, Named
Entity Recognition, Question/ Answering, so on
- Data cleaning from competence data and creating open-source training and evaluating data
- Evaluating generated retrospective plans and procedures using information retrieval metrics
- Utilizing NLP evaluation methods in various Question/Answering task such as Reading Comprehension (RC), Natural Yes and No Questions(BoolQ),
Question-answering NLI (QNLI) or Question-
answering entailment
- Generating new successful scenarios from those competence knowledge base

Proposed approach

Objectives

Research Qestions

Research Steps

Mission Assistant of Marine Robots by Encyclopaedic Roadmap

Mahya Kashani
Supervisor: Prof. Andrzej Wasowski
IT-University of Copenhagen

What kindof tasks do we have in NLP?

Text Classification

Knowledge Base Question Answering (KBQA)

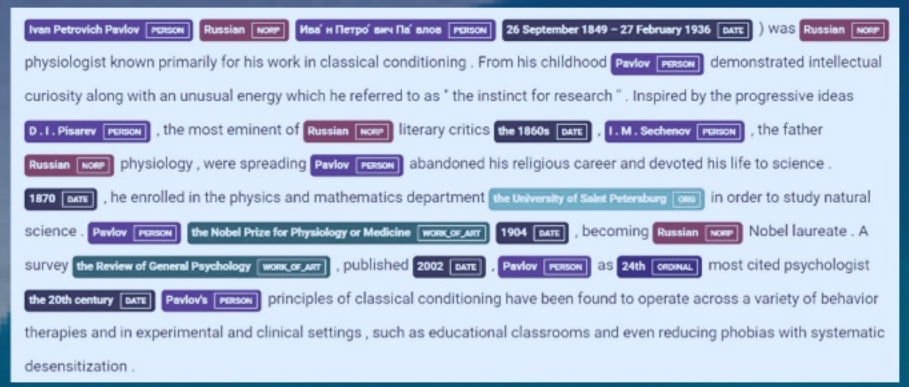
Relation Extraction (RE)

Open Domain Question Answering Model on Wikipedia
(ODQA)

Mission Assistant of Marine Robots by Encyclopaedic Roadmap

Mahya Kashani
Supervisor: Prof. Andrzej Wasowski
IT-University of Copenhagen

What is LLMs and how it works?

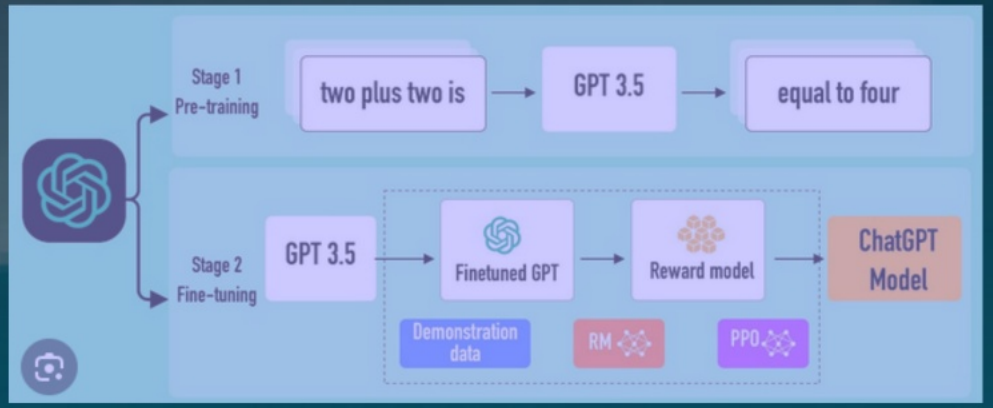


Architecture

How does it work?

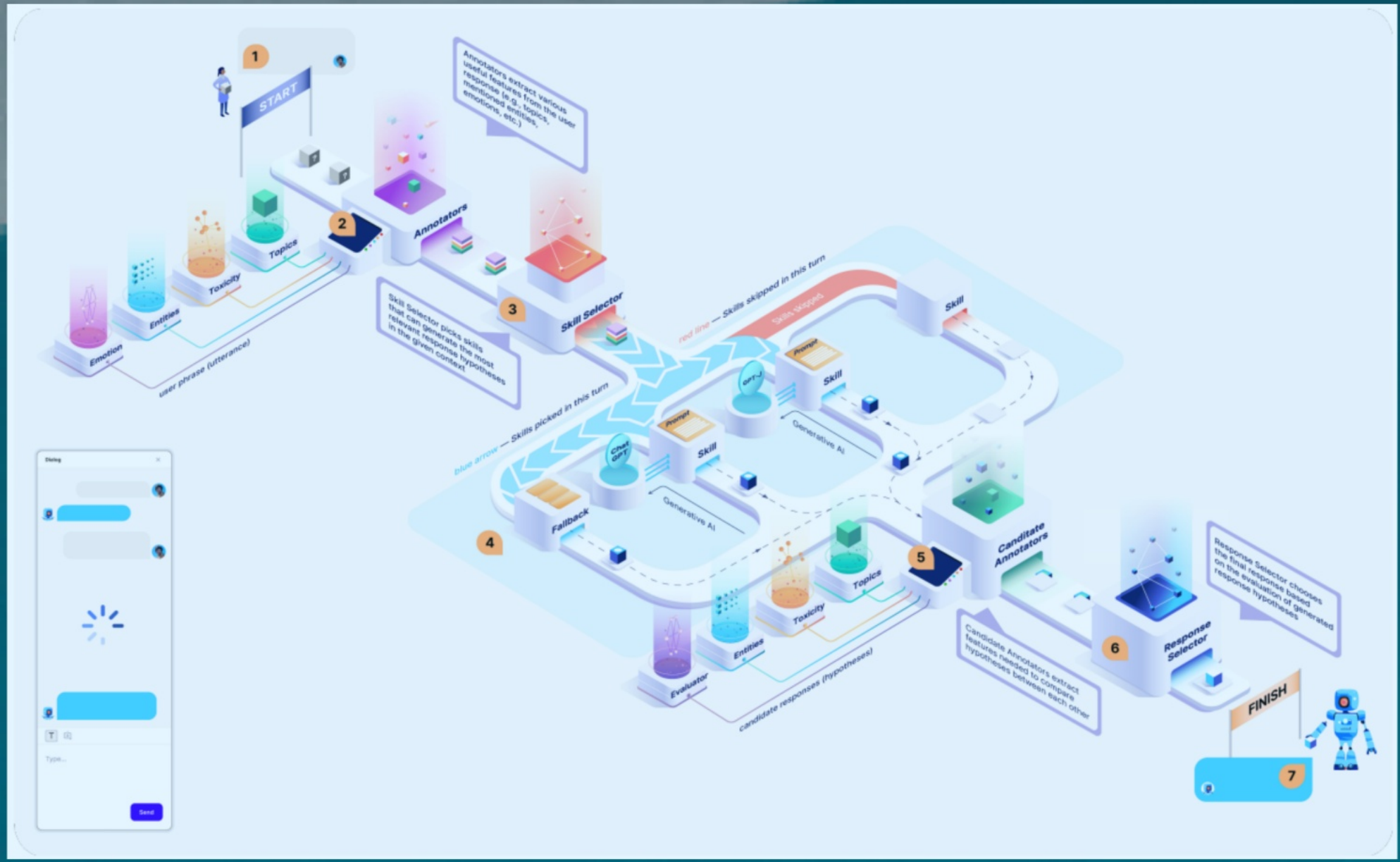
Ivan Petrovich Pavlov PERSON Russian NORP Ива́ н Петро́ вич Па́ влов PERSON 26 September 1849 – 27 February 1936 DATE) was Russian NORP physiologist known primarily for his work in classical conditioning . From his childhood Pavlov PERSON demonstrated intellectual curiosity along with an unusual energy which he referred to as " the instinct for research " . Inspired by the progressive ideas D . I . Pisarev PERSON , the most eminent of Russian NORP literary critics the 1860s DATE , I . M . Sechenov PERSON , the father Russian NORP physiology , were spreading Pavlov PERSON abandoned his religious career and devoted his life to science . 1870 DATE , he enrolled in the physics and mathematics department the University of Saint Petersburg ORG in order to study natural science . Pavlov PERSON the Nobel Prize for Physiology or Medicine WORK_OF_ART 1904 DATE , becoming Russian NORP Nobel laureate . A survey the Review of General Psychology WORK_OF_ART , published 2002 DATE , Pavlov PERSON as 24th ORDINAL most cited psychologist the 20th century DATE Pavlov's PERSON principles of classical conditioning have been found to operate across a variety of behavior therapies and in experimental and clinical settings , such as educational classrooms and even reducing phobias with systematic desensitization .

ChatGPT Architecture

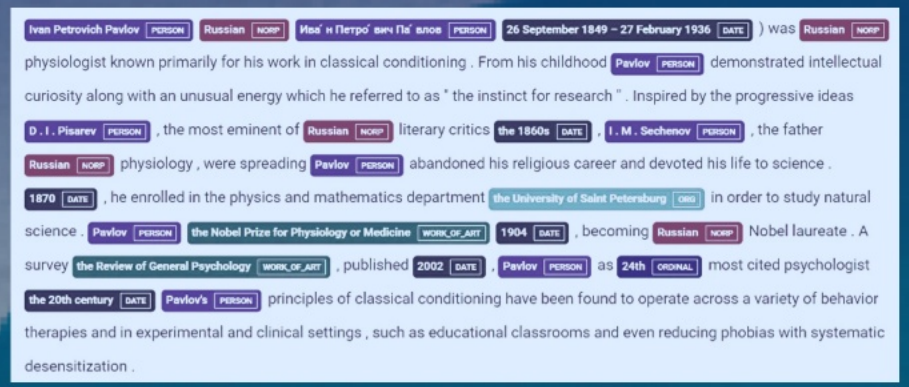


PAVLOV Dream Architecture

PAVLOV Dream Architecture



What is LLMs and how it works?



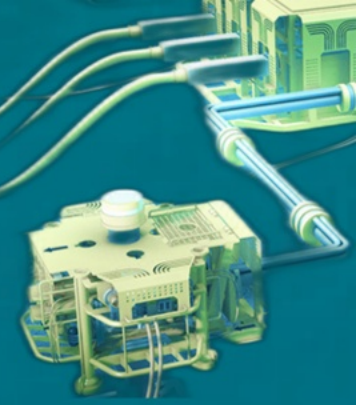
Architecture

How does it work?

Question- answering entailment using

DEEPPAVLOV.AI

Open Domain Question Answering Model



Sample

QA1

QA2

Take look into report in detail

3) ***Risk assessment document prepared by Gwyn Griffiths, NOCS, 31/07/06:***

FAULT ASSESSMENT AND ESTIMATED PROBABILITY OF LOSS UNDER ICE SHELF FOR AUTOSUB3

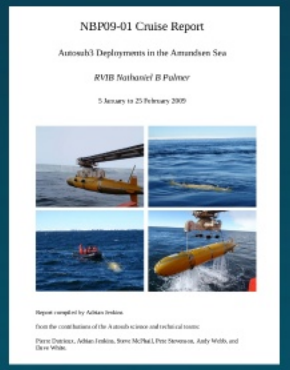
DERIVED FROM PERFORMANCE ON *DISCOVERY* 29ST JULY 2005, *TERSCHELLING* MAY 2006, *DISCOVERY* 306 JUNE-JULY 2006 AND *TERSCHELLING* JULY 2006, FORMING STEPS 2 AND 3 OF THE RISK MANAGEMENT PROCESS–AUV.

Gwyn Griffiths
National Oceanography Centre, Southampton. E: gxg@noc.soton.ac.uk T: 023 80596004

Based on mission fault information supplied by Steven McPhail

Table 3 *Discovery* June-July 2006

Mission	Distance (km)	No. Faults	Fault HIU?	Comment
401	2.5	2	N	1. Configuration Mistake. ADCP up was configured as a downward looking ADCP causing navigation problems as the sub was tracking sea surface as the reference. This velocity data was very noisy and put the vehicle navigation out by a factor of 1.5. 2. Damaged on recovery, "moderately serious" to sternplane. Discounted by PST as cause of sternplane actuator failure on m402.
402	274	5	Y(2) and possibly 3	1. Stern Plane stuck up during attempt to dive, 2d 20h into mission. Stern plane actuator had flooded. HIU. 2. Aborted due to netYdown. Abort release could not communicate with the Depth control node for period of 403 seconds. Possibly side-effect of actuator or motor problems. HIU. 3. Motor windings had resistance of 330ohm to case. Propeller speed dropping off gradually during a dive Possibly HIU. 4. Only one position fix from tail mounted ARGOS transmitter. 5. GPS antenna damaged on recovery.
403	140	3	Y as 1/4	1. Recovery light line was wrapped around the propeller on surface. Flaps covering the main recovery lines (and where the light line was towed) were open. Class a ¼ likely HIU subsurface. 2. Took over 1 hour to get GPS fix at final waypoint. GG comment: was this at all related to damage to GPS antenna on m402? 3. Propeller speed showed same problem as helux. Subsequent testing of motor with Megger showed resistances of a few kohm between windings.
404	75	7	Possible (1)	1. Pre-launch. Abort weight could not be successfully loaded due to distorted keeper. "If not spotted, could have dropped out during mission" Considered low probability of distortion ***and*** not checked. 2. Pre-launch. Potential short circuit in motor controller that could stop motor. 3. Propeller speed showed same problem as helux, Possible HIU. 4. CTD drop-out of 1 hour (shorter drop-outs noted in previous missions). 5. M404 recovery was complicated when lifting lines and streaming line became trapped on the rudder (probably stuck on the Bolet where the two were attached). Recovery from the situation required the trapped lifting lines grappled astern of the ship, attached to the gantry lines, and the caught end cut. 6. The forward sternplane was lost due to lifting line trapping between the fin and its flap. 7. The SeaBeam nose transducer was damaged due to collision with the ship.
Totals	**496.5**	**17**	2 but possibly 4¼	



NBP09-01 Cruise Report

Autosub3 Deployments in the Amundsen Sea

RVIB Nathaniel B Palmer

5 January to 25 February 2009

Report compiled by Adrian Jenkins

From the contributions of the Autosub science and technical teams:

Pierre Dutrieux, Adrian Jenkins, Steve McPhail, Pete Stevenson, Andy Webb, and Dave White.

Mutual Field Trials of the Manned Submersible JAGO and the Hover-AUVs ANTON and LUISE off the Aeolian Islands, Mediterranean Sea

Catania (Italy) – La Seyne-sur-mer (France)
05.02. – 18.02.2020

wyn Griffiths, NOCS, 31/07/06:

D PROBABILITY OF LOSS UNDER AUTOSUB3

FORMANCE ON
***LLING* MAY 2006, *DISCOVERY* 306**
***CHELLING* JULY 2006,**
K MANAGEMENT PROCESS–AUV.

iths
: gxg@noc.soton.ac.uk T: 023 80596004

supplied by Steven McPhail

y 2006

o. ults	Fault HIU?	Comment
2	N	1. Configuration Mistake. ADCP up was configured as a downward looking ADCP causing navigation problems as the sub was tracking sea surface as the reference. This velocity data was very noisy and put the vehicle navigation out by a factor of 1.5. 2. Damaged on recovery, "moderately serious" to stemplane. Discounted by PST as cause of stemplane actuator failure on m402.
5	Y(2) and possibly 3	1. Stern Plane stuck up during attempt to dive, 2d 20h into mission. Stern plane actuator had flooded. HIU. 2. Aborted due to netYdown. Abort release could not communicate with the Depth control node for period of 403 seconds. Possibly side-effect of actuator or motor problems. HIU. 3. Motor windings had resistance of 330ohm to case. Propeller speed dropping off gradually during a dive Possibly HIU. 4. Only one position fix from tail mounted ARGOS transmitter. 5. GPS antenna damaged on recovery.
3	Y as 1/4	1. Recovery light line was wrapped around the propeller on surface. Flaps covering the main recovery lines (and where the light line was towed) were open. Class a ¼ likely HIU subsurface. 2. Took over 1 hour to get GPS fix at final waypoint. GG comment: was this at all related to damage to GPS antenna on m402? 3. Propeller speed showed same problem as before.

NBP09-01 Cruise Report

Autosub3 Deployments in the Amundsen Sea

RVIB Nathaniel B Palmer

5 January to 25 February 2009

Report compiled by Adrian Jenkins

from the contributions of the Autosub science and technical teams:

Pierre Dutrieux, Adrian Jenkins, Steve McPhail, Pete Stevenson, Andy Webb, and Dave White.

Mutual Field Trials of the Manned Submersible JAGO and the Hover-AUVs ANTON and LUISE off the Aeolian Islands, Mediterranean Sea

Catania (Italy) – La Seyne-sur-mer (France)
05.02. – 18.02.2020

NBP09-01 Cruise Report

Autosub3 Deployments in the Amundsen Sea

RVIB Nathaniel B Palmer

5 January to 25 February 2009

Report compiled by Adrian Jenkins

from the contributions of the Autosub science and technical teams:

3) ***Risk assessment document prepared by Gwyn Griffiths, NOCS, 31/07/06:***

FAULT ASSESSMENT AND ESTIMATED PROBABILITY OF LOSS UNDER ICE SHELF FOR AUTOSUB3

DERIVED FROM PERFORMANCE ON *DISCOVERY* 295T JULY 2005, *TERSCHELLING* MAY 2006, *DISCOVERY* 306 JUNE-JULY 2006 AND *TERSCHELLING* JULY 2006, FORMING STEPS 2 AND 3 OF THE RISK MANAGEMENT PROCESS–AUV.

Gwyn Griffiths
National Oceanography Centre, Southampton. E: gxg@noc.soton.ac.uk T: 023 80596004

Based on mission fault information supplied by Steven McPhail

Table 3 *Discovery* June-July 2006

Mission	Distance (km)	No. Faults	Fault HIU?	Comment
401	7.5	2	N	1. Configuration Mistake. ADCP up was configured as a downward looking ADCP causing navigation problems as the sub was tracking sea surface as the reference. This velocity data was very noisy and put the vehicle navigation out by a factor of 1.5. 2. Damaged on recovery, "moderately serious" to sternplane. Discounted by PST as cause of sternplane actuator failure on m402.
402	274	5	Y(2) and possibly 3	1. Stern Plane stuck up during attempt to dive, 2d 20h into mission. Stern plane actuator had flooded. HIU. 2. Aborted due to netYdown. Abort release could not communicate with the Depth control node for period of 403 seconds. Possibly side-effect of actuator or motor problems. HIU. 3. Motor windings had resistance of 330ohm to case. Propeller speed dropping off gradually during a dive Possibly HIU. 4. Only one position fix from tail mounted ARGOS transmitter. 5. GPS antenna damaged on recovery.
403	140	3	Y as 1/4	1. Recovery light line was wrapped around the propeller on surface. Flaps covering the main recovery lines (and where the light line was towed) were open. Class a ¼ likely HIU subsurface. 2. Took over 1 hour to get GPS fix at final waypoint. GG comment: was this at all related to damage to GPS antenna on m402? 3. Propeller speed showed same problem as before. Subsequent testing of motor with Megger showed resistances of a few kohm between windings.
404	75	7	Possible (1)	1. Pre-launch. Abort weight could not be successfully loaded due to distorted keeper. "If not spotted, could have dropped out during mission" Considered low probability of distortion ***and*** not checked. 2. Pre-launch. Potential short circuit in motor controller that could stop motor. 3. Propeller speed showed same problem as before, Possible HIU. 4. CTD drop-out of 1 hour (shorter drop-outs noted in previous missions). 5. M404 recovery was complicated when lifting lines and streaming line became trapped on the rudder (probably stuck on the Bolen where the two were attached). Recovery from the situation required the trapped lifting lines grappled astern of the ship, attached to the gantry lines, and the caught end cut. 6. The forward sternplane was lost due to lifting line trapping between the fin and its flap. 7. The SeaPam nose transducer was damaged due to collision with the ship.
Totals	**496.5**	**17**	2 but possibly 4¼	

Report compiled by Adrian Jenkins

from the contributions of the Autosub science and technical teams

Pierre Dutrieux, Adrian Jenkins, Steve McPhail, Pete Stevenson, A
Dave White.

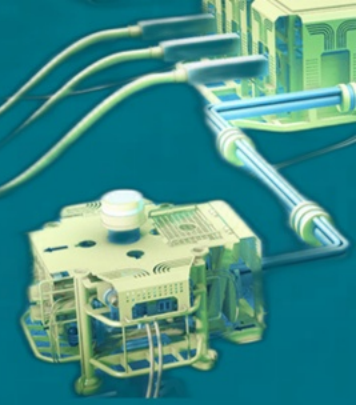
**Mutual Field Trials of the Manned Subm
and the Hover-AUVs ANTON and
off the Aeolian Islands, Mediterra**

Catania (Italy) – La Seyne-sur-me
05.02. – 18.02.2020

Question- answering entailment using

DEEPPAVLOV.AI

Open Domain Question Answering Model



Sample

QA1

QA2

Answer: 57 – 87%

Question: what is the pessimistic estimation for probability of vehicle loss when there is no fast ice present?

The fault history of Autosub3 during its 2005 and 2006 engineering trials campaigns are analysed to provide an estimate of the probability of loss if used on a campaign of under ice missions proposed by Dr A Jenkins (BAS). Dr Jenkins' requirement (Annex A) forms Step 2 of the Risk Assessment Process-AUV (RMP-AUV); this analysis is Step 3. The responsible owner has yet to declare their acceptable risk (Step 1). Based on four different analysis methods, we estimate that for Dr Jenkins' minimum requirements, and no fast ice present, the optimistic probability of loss to be between 35 and 53% (pessimistic estimate is **57 – 87%** [A]). For his full requirements the optimistic estimate lies between 57 – 88% (the pessimistic between 85 – 97%). The probability of loss is increased in the vehicle would need to traverse under fast sea ice to reach the ice shelf.

Answer: 85 – 97%

Question: what is the pessimistic estimation for probability of vehicle loss when we analyze with Jenkin's full requirements?

The fault history of Autosub3 during its 2005 and 2006 engineering trials campaigns are analysed to provide an estimate of the probability of loss if used on a campaign of under ice missions proposed by Dr A Jenkins (BAS). Dr Jenkins' requirement (Annex A) forms Step 2 of the Risk Assessment Process-AUV (RMP-AUV); this analysis is Step 3. The responsible owner has yet to declare their acceptable risk (Step 1). Based on four different analysis methods, we estimate that for Dr Jenkins' minimum requirements, and no fast ice present, the optimistic probability of loss to be between 35 and 53% (pessimistic estimate is 57 – 87%). For his full requirements the optimistic estimate lies between 57 – 88% (the pessimistic between **85 – 97%** [A]). The probability of loss is increased in the vehicle would need to traverse under fast sea ice to reach the ice shelf.

2 paragraphs from the report

Answer: 57 – 87%

Question: what is the pessimistic estimation for probability of vehicle loss when there is no fast ice present?

The fault history of Autosub3 during its 2005 and 2006 engineering trials campaigns are analysed to provide an estimate of the probability of loss if used on a campaign of under ice missions proposed by Dr A Jenkins (BAS). Dr Jenkins' requirement (Annex A) forms Step 2 of the Risk Assessment Process-AUV (RMP-AUV); this analysis is Step 3. The responsible owner has yet to declare their acceptable risk (Step 1). Based on four different analysis methods, we estimate that for Dr Jenkins' minimum requirements, and no fast ice present, the optimistic probability of loss to be between 35 and 53% (pessimistic estimate is **57 – 87% A**). For his full requirements the optimistic estimate lies between 57 – 88% (the pessimistic between 85 – 97%). The probability of loss is increased in the vehicle would need to traverse under fast sea ice to reach the ice shelf.

Answer: 85 – 97%

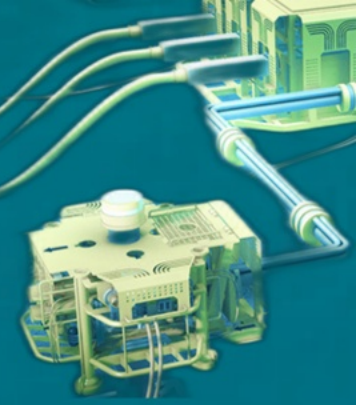
Question: what is the pessimistic estimation for probability of vehicle loss when we analyze with Jenkin's full requirements?

The fault history of Autosub3 during its 2005 and 2006 engineering trials campaigns are analysed to provide an estimate of the probability of loss if used on a campaign of under ice missions proposed by Dr A Jenkins (BAS). Dr Jenkins' requirement (Annex A) forms Step 2 of the Risk Assessment Process-AUV (RMP-AUV); this analysis is Step 3. The responsible owner has yet to declare their acceptable risk (Step 1). Based on four different analysis methods, we estimate that for Dr Jenkins' minimum requirements, and no fast ice present, the optimistic probability of loss to be between 35 and 53% (pessimistic estimate is 57 – 87%). For his full requirements the optimistic estimate lies between 57 – 88% (the pessimistic between **85 – 97%** [A]). The probability of loss is increased in the vehicle would need to traverse under fast sea ice to reach the ice shelf.

Question- answering entailment using

DEEPPAVLOV.AI

Open Domain Question Answering Model



Sample

QA1

QA2

Answer: Weibull distribution

Question: how to assess fault history for a mission? demonstrate using statistics.

Griffiths et al. (2003) showed that, over a sample of 240 Autosub missions, the fault history could be represented by a **Weibull distribution** [A] . If that is also the case over these fewer missions, we can use this method to estimate probability of loss based on mission length as well as the number of missions. For the combined trials, Figure 3 shows the optimistic assessment (left) and the pessimistic assessment with the 'possible' HIU faults included. Note that the

Answer: mission length

Question: what is the most important factor to assess fault history for a mission?

Griffiths et al. (2003) showed that, over a sample of 240 Autosub missions, the fault history could be represented by a Weibull distribution. If that is also the case over these fewer missions, we can use this method to estimate probability of loss based on **mission length** [A] as well as the number of missions. For the combined trials, Figure 3 shows the optimistic assessment (left) and the pessimistic assessment with the 'possible' HIU faults included. Note that the Weibull distribution estimate is, in each case, to the right of the lines showing the actual HIU fault history. This is because of the censored data, that is, those missions that did not suffer a HIU fault. Their inclusion tends to increase the probability of survival over any set distance. Unfortunately, due to the very small sample, there are large confidence limits on the parameters of the Weibull distribution (alpha and beta), Table 6.

Answer: mission length

Question: what is the most important factor to assess fault history for a mission?

Griffiths et al. (2003) showed that, over a sample of 240 Autosub missions, the fault history could be represented by a Weibull distribution. If that is also the case over these fewer missions, we can use this method to estimate probability of loss based on **mission length** [A] as well as the number of missions. For the combined trials, Figure 3 shows the optimistic assessment (left) and the pessimistic assessment with the 'possible' HIU faults included. Note that the Weibull distribution estimate is, in each case, to the right of the lines showing the actual HIU fault history. This is because of the censored data, that is, those missions that did not suffer a HIU fault. Their inclusion tends to increase the probability of survival over any set distance. Unfortunately, due to the very small sample, there are large confidence limits on the parameters of the Weibull distribution (alpha and beta), Table 6.

Answer: Weibull distribution

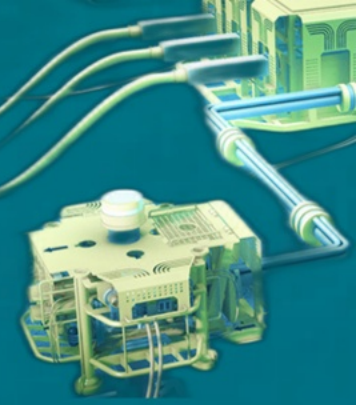
Question: how to assess fault history for a mission? demonstrate using statistics.

Griffiths et al. (2003) showed that, over a sample of 240 Autosub missions, the fault history could be represented by a **Weibull distribution** [A] . If that is also the case over these fewer missions, we can use this method to estimate probability of loss based on mission length as well as the number of missions. For the combined trials, Figure 3 shows the optimistic assessment (left) and the pessimistic assessment with the 'possible' HIU faults included. Note that the

Question- answering entailment using

DEEPPAVLOV.AI

Open Domain Question Answering Model

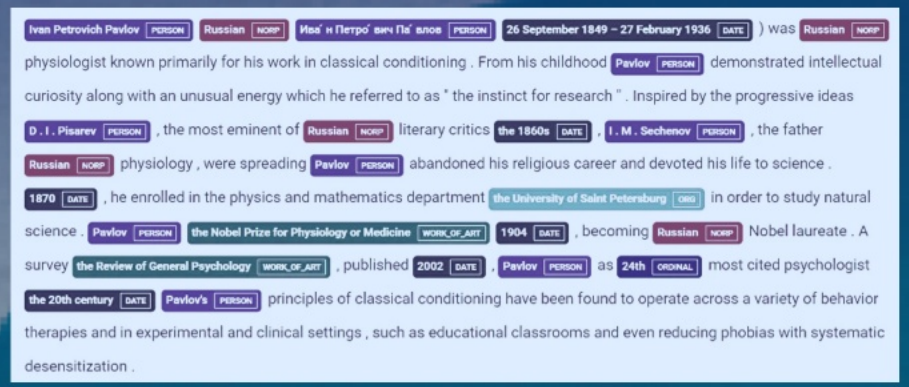


Sample

QA1

QA2

What is LLMs and how it works?



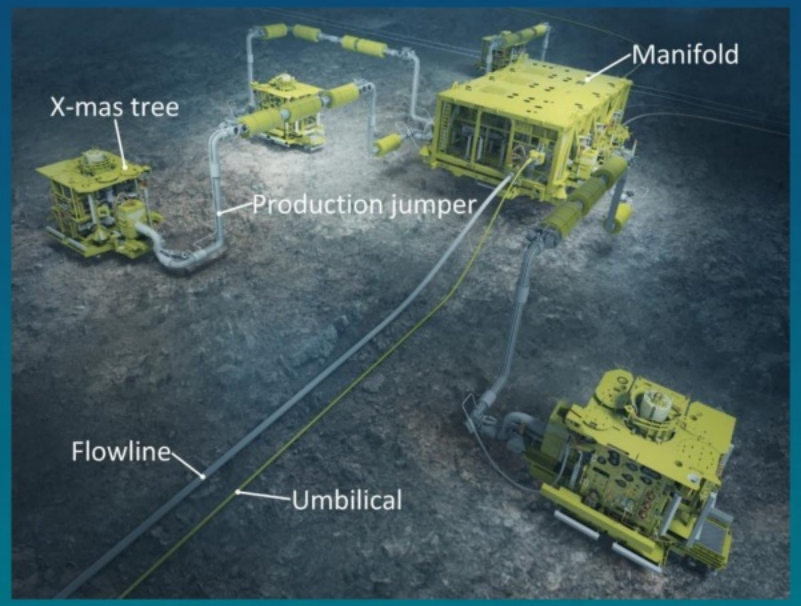
Architecture

How does it work?

Mission Assistant of Marine Robots by Encyclopaedic Roadmap

Mahya Kashani
Supervisor: Prof. Andrzej Wasowski
IT-University of Copenhagen

Conclusion & Future Work



Conclusion

Future Work

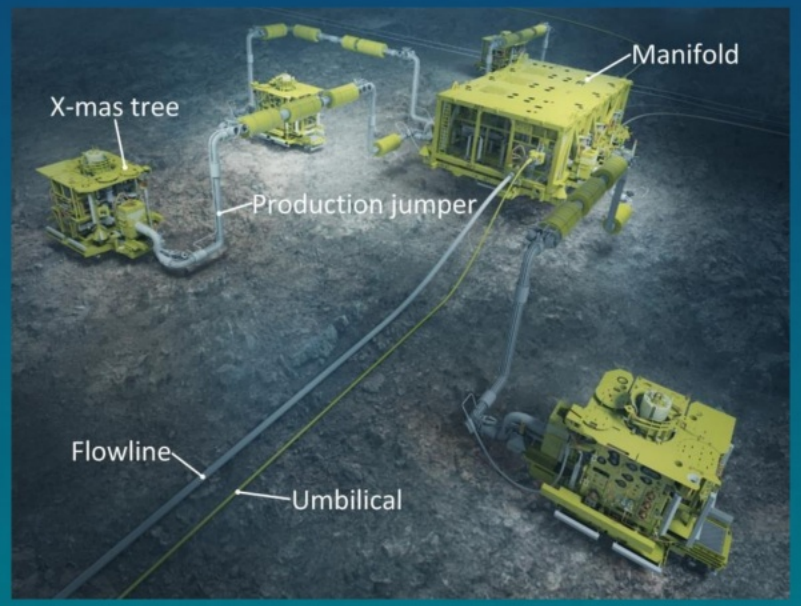
Conclusion

Reading and Summarising massive reports is exhaustive

Using LLMs, we can summarise, analysis and respond questions from collected report faster

According to PSA regulations, using new risk definition is necessity, we need to shift our horizon to solve probabilistic planning

Conclusion & Future Work



Conclusion

Future Work

In Progress work

Data Collection and Cleaning

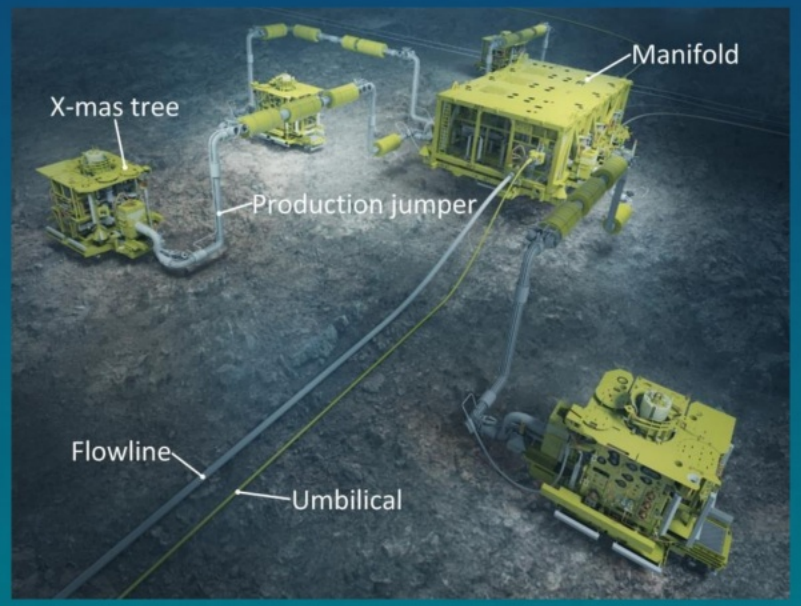
Having end-to-end workflow from reading data to responding questions

Future Work

Other Data types extractions, e.g. charts, plots, tables

finding meaningful relation between textual content and other data types

Conclusion & Future Work



Conclusion

Future Work

Mission Assistant of Marine Robots by Encyclopaedic Roadmap

Mahya Kashani
Supervisor: Prof. Andrzej Wasowski
IT-University of Copenhagen