Artificial Intelligence Software Development

SNC·LAVALIN

ATKINS
Member of the SNC-Lavalin Group

How AI is impacting our lives?

TechVidvan

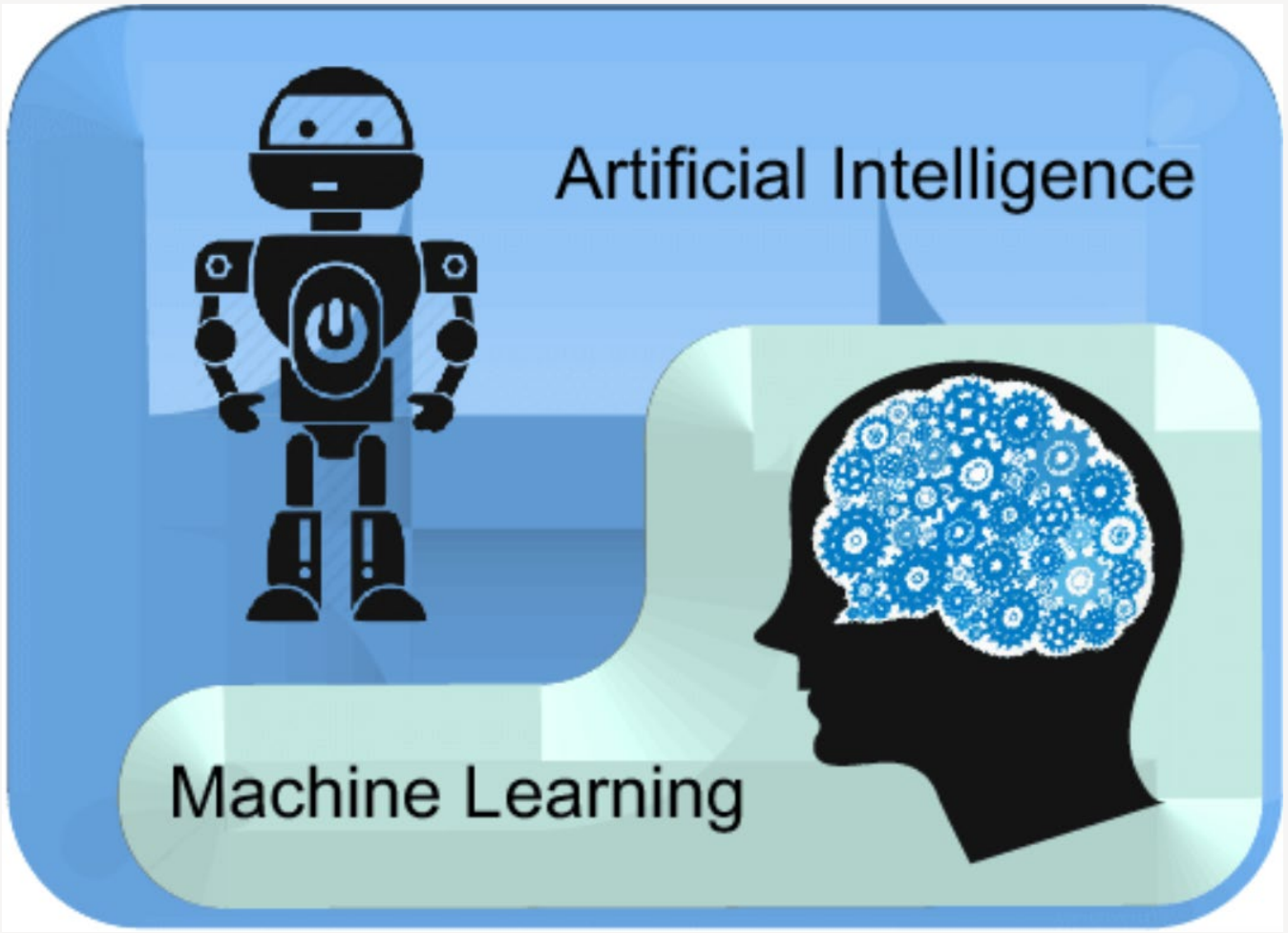
SNC·LAVALIN

ATKINS
Member of the SNC-Lavalin Group

Artificial Intelligence

The development of computer systems able to perform tasks that normally require human intelligence, such as:

- visual perception,
- speech recognition,
- decision-making, and
- translation between languages.



Network Rail

Model identified, classified and quantified the risk of ground movement around 190,000 earthwork assets.

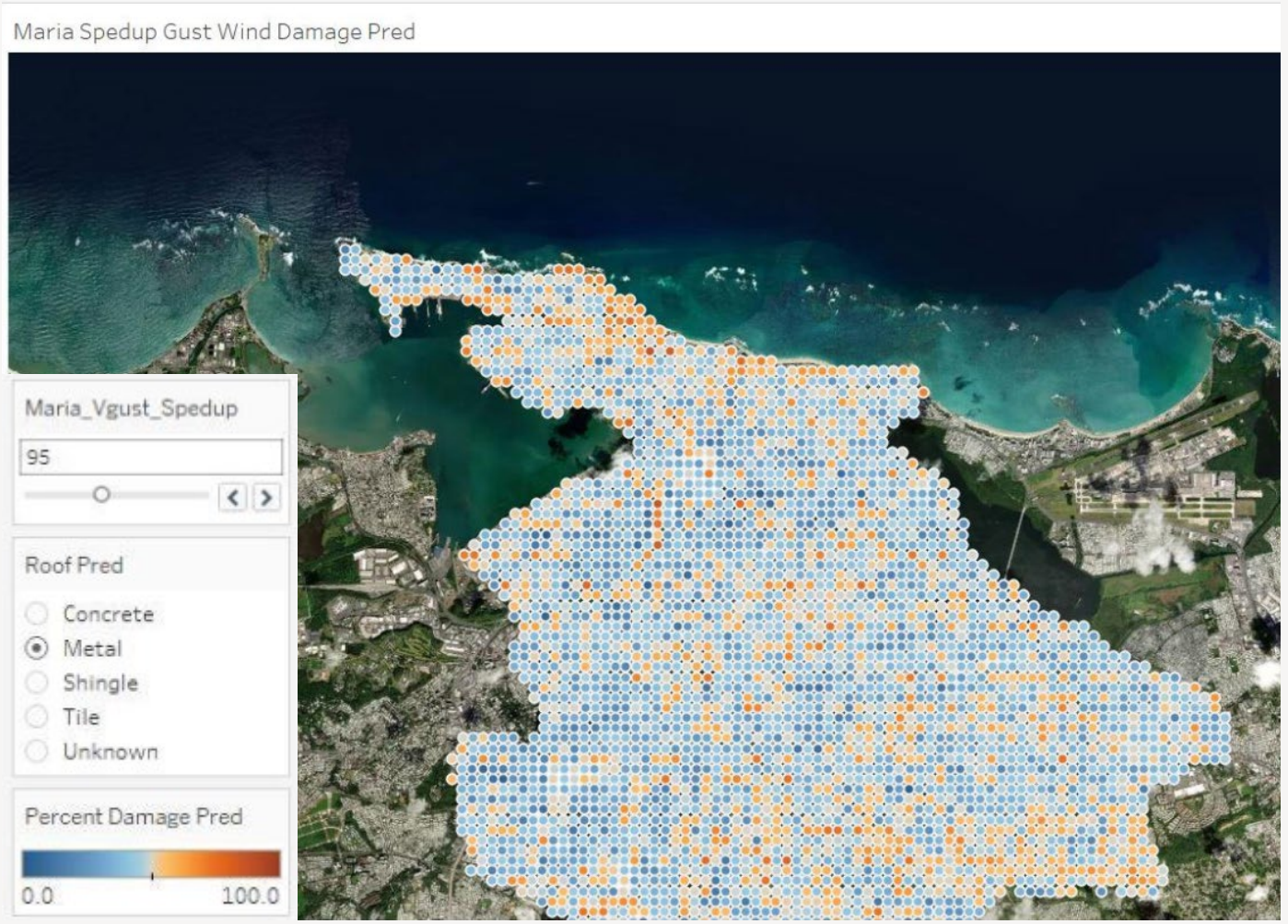
- Improved track safety
- Reduced Manual Survey Frequency

SNC·LAVALIN ATKINS Member of the SNC-Lavalin Group

Substantial Damage Estimation (SDE)

AI model developed to estimate residential damage patterns.

Model reduced overall number of inspections by 80%.

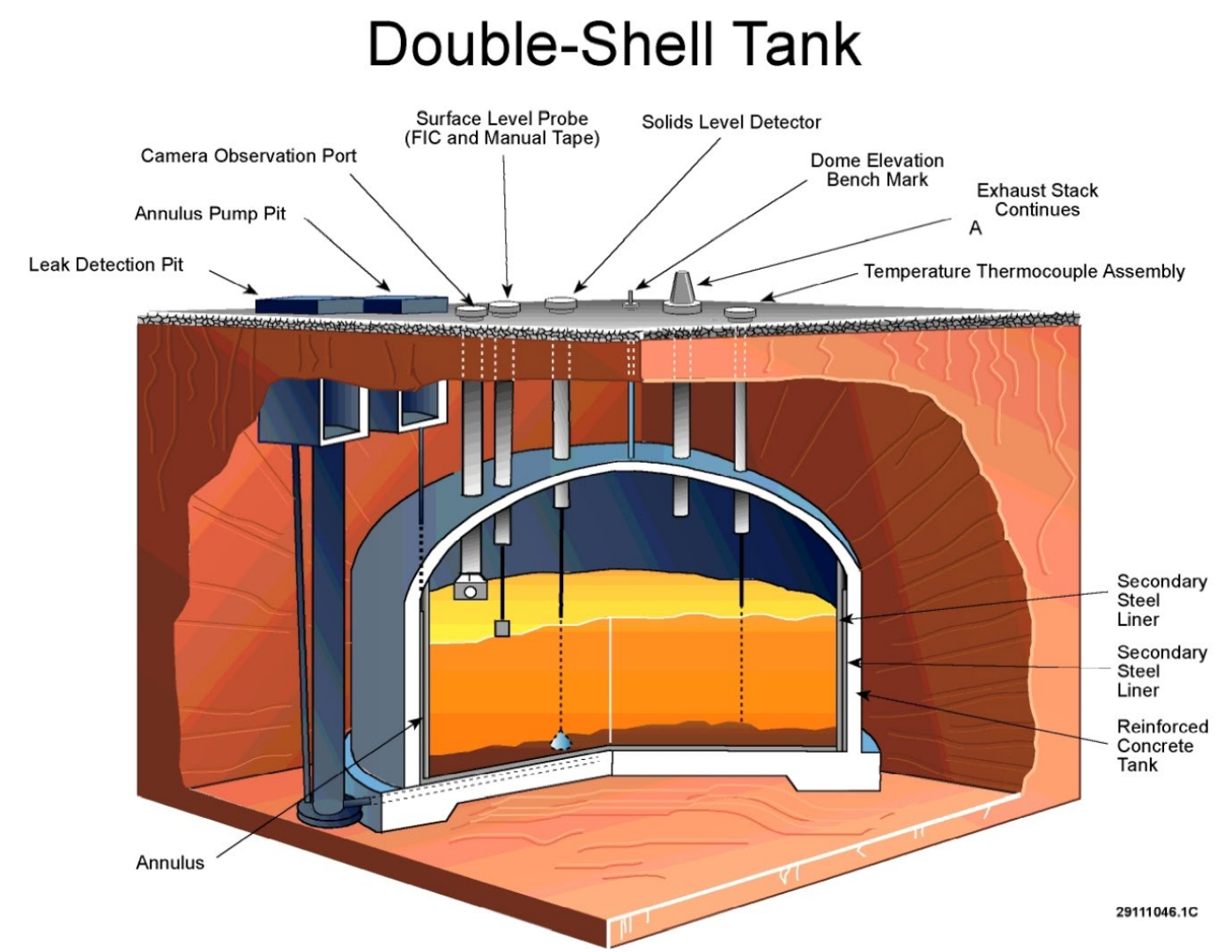


Hanford Tank Farms

- 177 waste storage tanks
- 149 single-shell
- 28 double-shell
- Up to 1,000,000 gallons each

DST

- Constructed 1968
- Carbon-steel tank
- AY-102 Leak
- Transferred waste
- Avg. 3-10 mils per year corrosion



The Challenge

- DST annulus inspections
- SST in-tank inspections
- Remote inspection
- Performed every 3-10 years
- 6-10 hours of video recordings per tank
- Enormous volume of data to review

Machine Learning

Structure	Attributes
Data	Input needed to train your model and generate predications
Infrastructure	Platforms and tools for processing data including libraries and programming languages
Algorithms	Tools for analyzing data including linear regression, decision trees, ensemble modeling, and neural networks (e.g., TensorFlow).
Visualization	Tools to highlight and communicate results to the relevant decision makers including graphs, scatterplots, heatmaps, box plots and figures.

Data

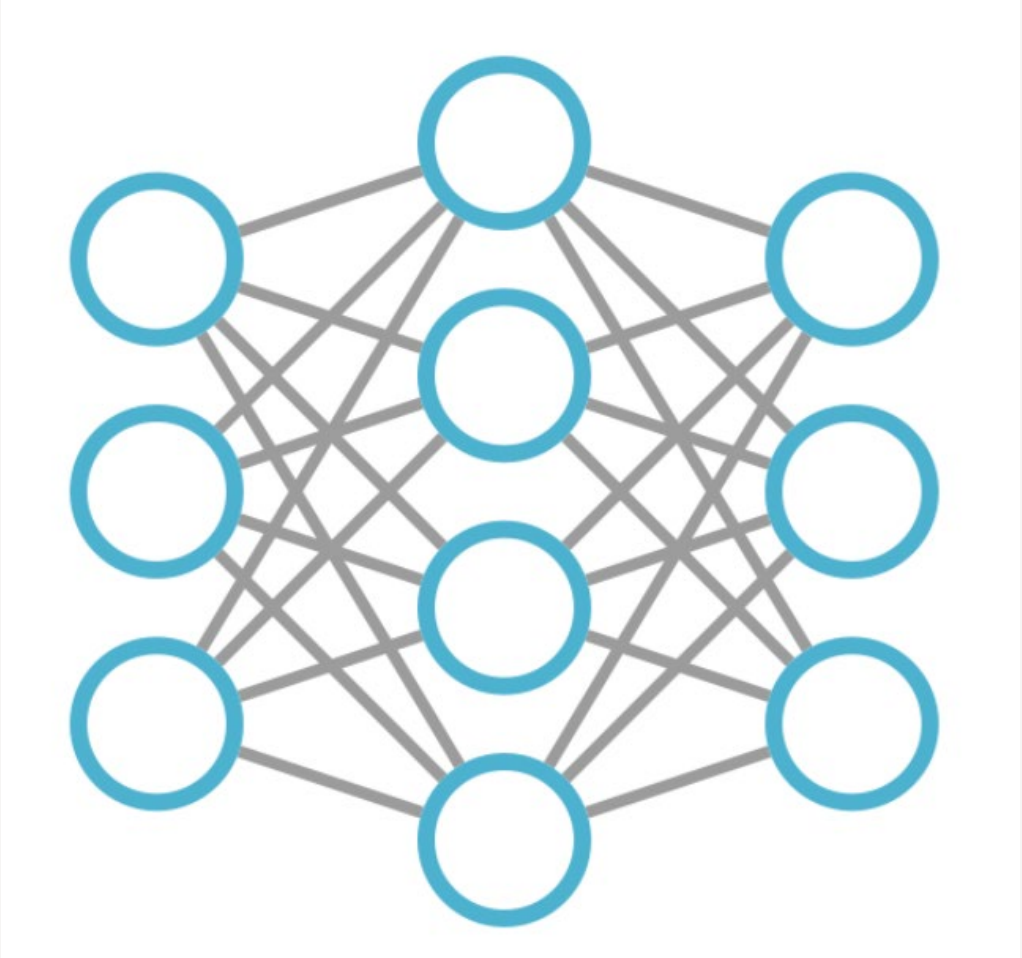
A machine learning algorithm is only as good as the data it's fed. To use machine learning effectively, you must have the right data for the problem you're trying to solve. And not just a few data points. Machines need a lot of data to learn — think hundreds of thousands of data points.

Infrastructure

- Programming language
- Development Environment
- Data Libraries
- Visualization Methods

Algorithms

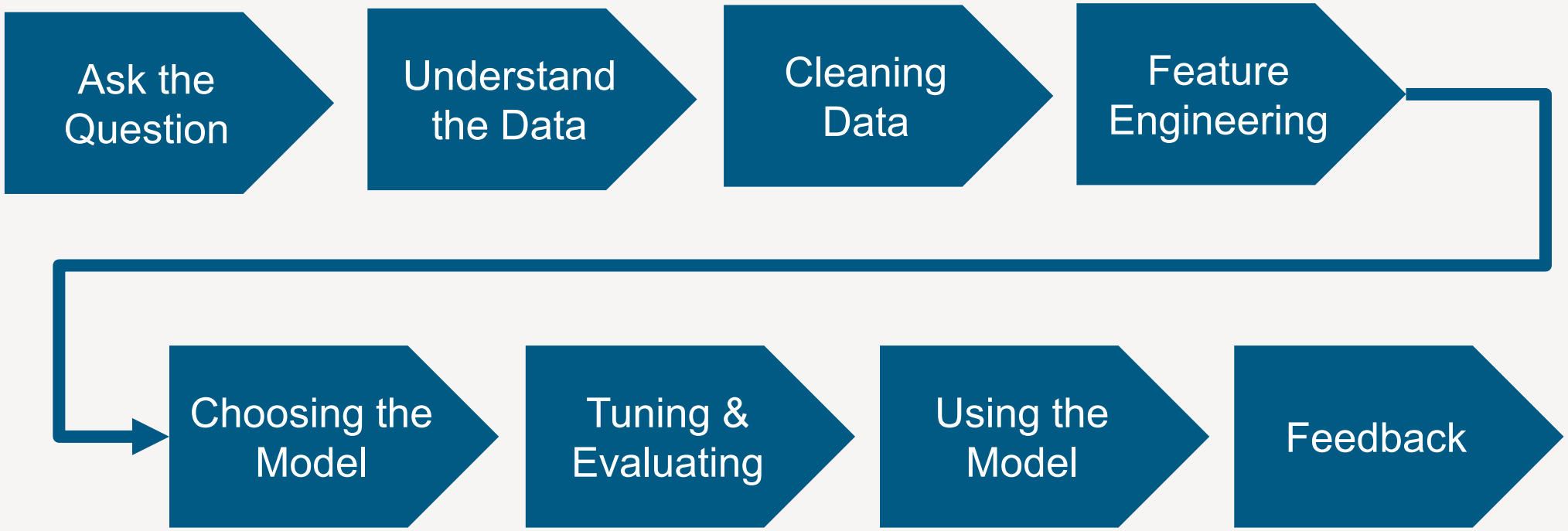
Once machines have learned how to identify images and find patterns, they can look at datasets and make predictions about new or future data. An algorithm can even tell you what data might be a better predictor, so you can adjust your inspection strategy.



Visualization

One of the hallmarks of useful AI and ML applications is a highly customized, visual representation of the model that the AI expert develops. In most AI models, this feature is created through the use of graph-based neural networks.

Machine Learning Process



AI Failures

- TESLA X fatality
- TESLA S fatality
- TESLA 3 fatality
- Uber fatality
- Robot crash

SNC·LAVALIN ATKINS Member of the SNC-Lavalin Group

Common Pitfalls

1. Cold Starts
2. Expecting the AI to do all the work
3. Rigid frameworks
4. Meaningless metrics
5. Setting and forgetting
6. Missing the bigger picture
7. Trapping users in bubbles
8. Failing to optimise processing time
9. Not valuing the employees
10. Not upskilling your team

By Sam Franklin

Nuclear Quality Assurance

- Software Engineering
- Baseline documentation
- Reviews
- Configuration Management
- Problem Reporting
- Procurement
- Operations
- Maintenance
- Standards & Conventions
- Support Software

SNC·LAVALIN ATKINS Member of the SNC-Lavalin Group

Application of NQA-1 requirements to AI – Part 1

Subpart 2.7

- Software Engineering
- Baseline documentation
  - Design Req’ts
  - Reviews

AI Process

- Ask the Question
- Understand the Data
- Cleaning Data
- Data Validation

SNC·LAVALIN ATKINS Member of the SNC-Lavalin Group

Data Acquisition

- LIDAR
- Color Camera
- 20 Cameras
- GPS
- Front LIDAR
- Rear LIDAR
- Side LIDAR
- Cooling System

Application of NQA-1 requirements to AI – Part 2

Subpart 2.7

- Software Engineering
- Baseline documentation
  - Design
  - Reviews
  - Code
  - Reviews

AI Process

- Feature Engineering
- Developing Model

Feature Engineering

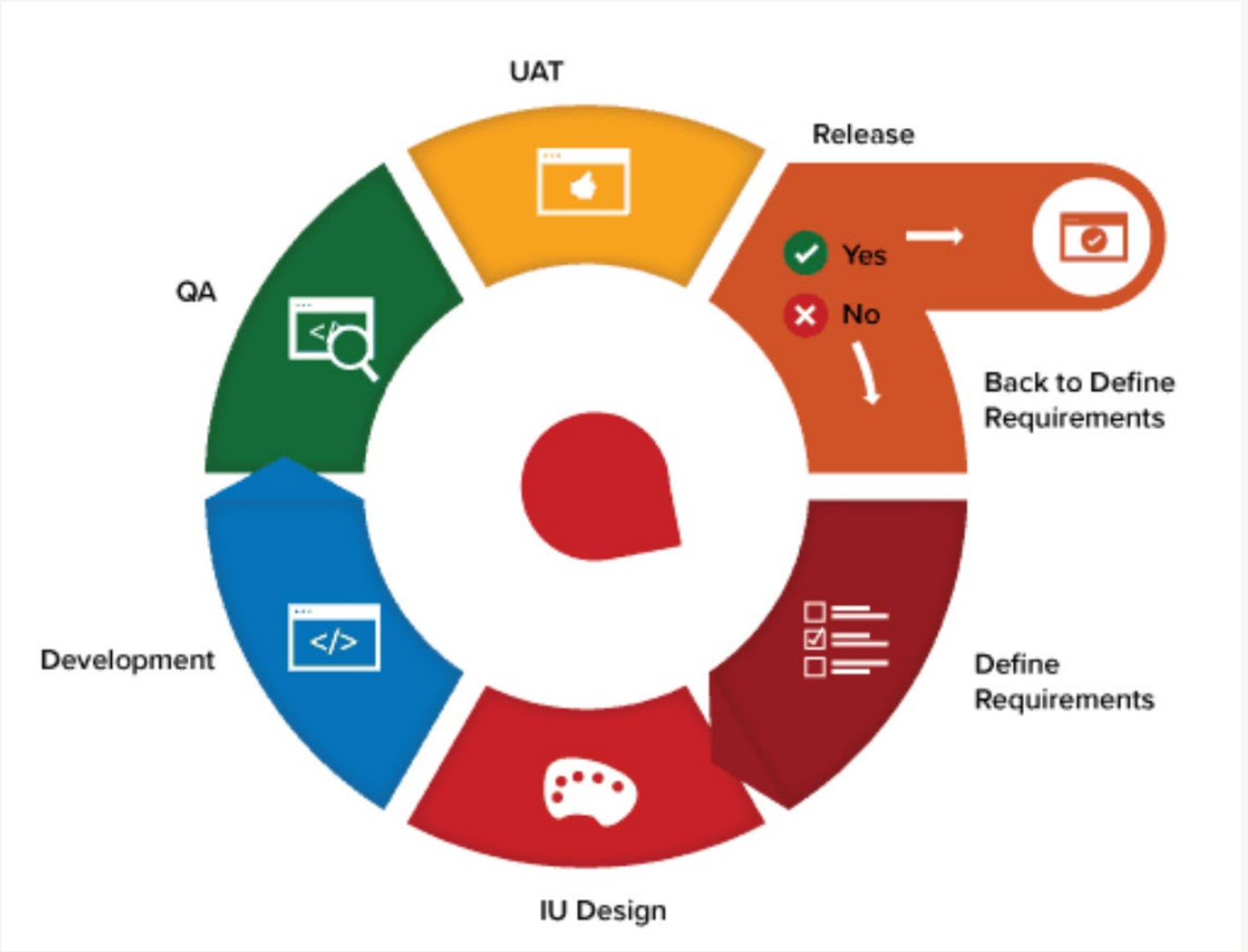
Feature Design did not:

- Recognize Pedestrian
- Limited to crosswalk
- 6 seconds reaction time
- Cycled between nodes (vehicle/bicycle/unknown)
- Collision warning off
- Emergency braking off

Develop Model

Model Development:

- Concept
- Inception
- Iteration/Construction
  - Requirements
  - Development
  - Testing
  - Delivery
  - Feedback
- Release



Application of NQA-1 requirements to AI – Part 3

Subpart 2.7

- Acceptance Testing

AI Process

- Tuning & Evaluating
- Fault testing
- Ethical check
- Back-end review

SNC·LAVALIN ATKINS Member of the SNC-Lavalin Group

Application of NQA-1 requirements to AI – Part 4

Subpart 2.7 – cont'd

- Configuration Management

AI Process

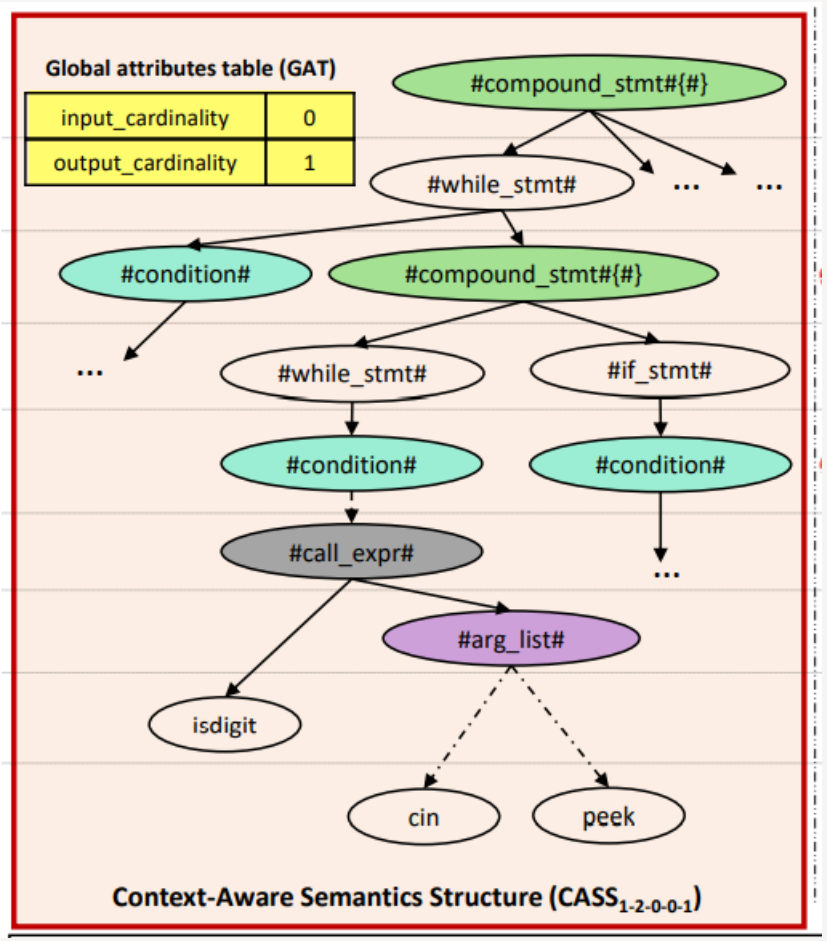
- Model Modifications
- Data Libraries
- MISIM
- Automatic maintenance

- Problem Reporting

- Error Handling
- Feedback

Machine Inferred Code Similarity (MISIM)

- Trains on huge amount of code already publicly available
- Figures out what the program is supposed to do
- Compares program to other similar programs.
- Makes the program faster or more efficient.



Application of NQA-1 requirements to AI – Part 5

Subpart 2.7 – cont'd

- Procurement
- Operations/Maintenance

- Standards & Conventions
- Support Software

AI Process

- Procurement
- Using the Model
- Feedback
- Error Reporting

- Development Env.

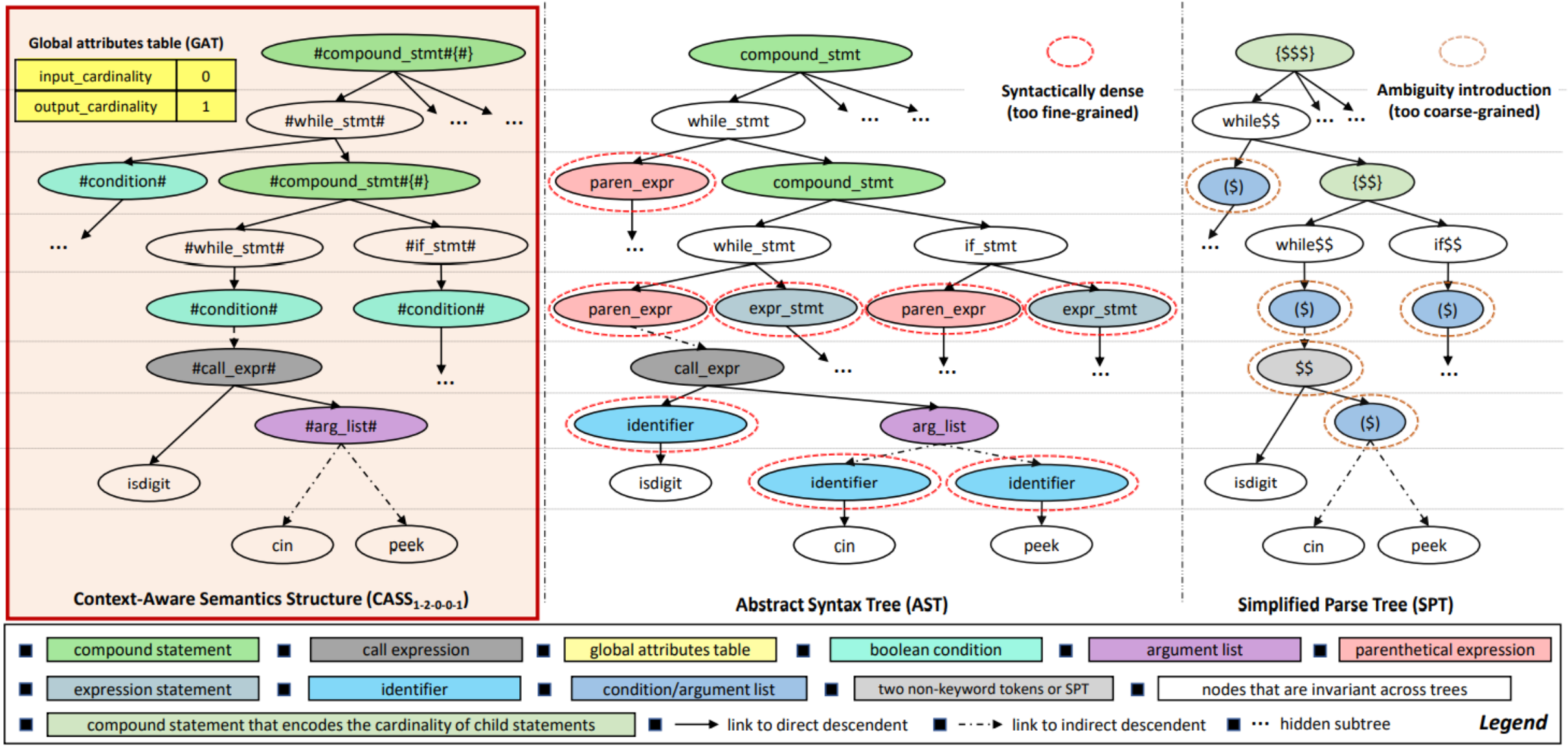
Summary

Subpart 2.7

- Software Engineering
- Baseline documentation
  - Design Requirements
  - Design
  - Code
- Acceptance Testing
- Operation/Maintainence

AI Process

- Focus on End Goal
- Emphasize DATA
- Empirical Process
- Feature Engineering
- Developing Model
- Acceptance Testing
- Use Model
- Iterative Process



SNC·LAVALIN

ATKINS
Member of the SNC-Lavalin Group