AI Techniques
Augmenting Data to Create Insights and Support Decision Making
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Why do we need AI?

- AI = Intelligence demonstrated by machines
- Identify the Need, Value and Fit for Artificial Intelligence (AI)
  - Use cases
Why do we need AI?

- **Use Cases – Subsea Inspection**
  - Components of AI
Why do we need AI?

- Deal with large data volumes
- Accrue our knowledge effectively
- Speed-up processing times
- Increase business efficiency
- Machine supports person
- Analyse data easily
- Minimise time to delivery
Our Ecosystem & Data Structure

Survey
- Navigation Data
- Multi-beam seabed data
- Sonar Data
- 3-D Point clouds

Inspection
- HD Video
- CP Data
- Sensor Data
- Events and Reports

Integrity Engineering
- Risk based Inspection planning
- Subsea system prognostics – real time condition monitoring data
- Flow assurance data

Environmental
- Tide / current / weather

Condition Monitoring
- Fixed sensors (pressure / temp / vibration)
- Temporary sensors (e.g. CP or strain)
- In built monitoring (e.g. Fibre Optic in EHTF / Bundles / Risers)

ROVs
- Remote Piloting from onshore
- Remote maintenance and monitoring
- Onshore system history
- Logistics / Spares etc

Design & Engineering
- Records, procedures, design info

Archive
- Historical year on year records
- Database of change
**Data Management**

**Automated CP Data Processing**

**Benefits:** Reduced cost, faster delivery, higher quality and consistency of data product, predict

**FDI for Pipeline Inspection**

**Benefits:** Significant reduction in vessel days, reduced volume of images for review, predict

**Machine Vision for Inspection Data**

**Benefits:** Reduced costs, reduced volume of images to review, faster delivery
AI to Automate Inspection

- **Millions of images** / hours of video
- Need to know event locations
- **Difficulties**
  - Wide variety of events
  - Variation in look of each event
  - Different **acquisition methods**
  - Changing and varied **environmental conditions**
  - Different client standards

**Acquire**
- Stills
- Navigation

**Process**
- Automated Detection
- Manual Review

**Deliver**
- Static Reports
- QC
AI to Automate Inspection

a. **Machine vision**
   event detection

b. **Machine learning**
   event classification

c. Event management in
   user interface

d. Compare with **known events**
   from previous inspection
General Visual Inspection Support (GVI)

Features

- Using WROVs, autonomous systems & divers
- Advanced modern cameras, lighting and lasers for fast optimised data collection
- Augmented by 3-D sonar / laser point cloud collection
- Smart data mining using AI and machine vision techniques
Edge Processing

- Automation enables edge processing
Augmented Intelligence
Digital Twin

**Purpose**
- Digital replica of a physical entity
- Understand, predict and optimise

**Features**
- Data from different sources
- Physics or AI based **analytics**

**Benefits**
- Insights for decision support
- Maximise value from **data**
Digital Twin - Insight and Operation Planning

**A Machine Vision**
Automating the inspection process to identify anomalies from inspection and other survey data reduces campaign durations and cost. Reduction in costs and time to delivery.

**B Visualisation**
Distil captured and analysed data into an at-a-glance presentation of asset status. Examine and understand trends and patterns.

**C Efficient Planning**
Optimise inspection, maintenance and repair schedules. Enabling proactive, predictive and minimising reactionary programmes.

**D Remnant Life**
Quantifying the effects of operations based on recorded data reduces design conservatisms. Predicted life of assets can be used for advanced planning.
Digital Asset Integrity Management

A Inspection
Purpose driven vehicles and tools for optimised inspection.
- ROV, AIV
- GVI support
- Cathodic Protection

B Monitoring
Sensors for on-demand condition assessment of assets.
- Structural, Process and Condition
- Environment and Vessel
- Capture Operational Behaviour

C Data Management
Subsea and topside data management
- Digital platform (storage, security, API)
- Digital twin (automated analytics)
- Visualisation (dashboard, GIS, AR)

D Integrity Analytics
Assessment of data for actionable insights
- Integrity planning (RBI, Anomaly)
- Fitness for Service (FFS)
- Life extension
Case Study: **Inspection**

**High Speed, High Definition Pipeline Inspection**

**Client:** BP  
**Location:** North Sea

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**Overview**

i-Tech 7 has successfully completed a high speed, high definition pipeline General Visual Inspection (GVI) for BP, West of Shetland from the Normand Subsea, using a Hercules Workclass ROV. The survey was completed in water depths ranging from 10m to 220m.

**Scope**

The objective of the inspection was to record and quantify the overall condition of over **290km** of pipeline at high speed capturing all pipeline events and anomalies such as field joints, anodes, free spans, damage and debris.

**Solution**

Achieving a survey speed up to 4.5 km/h, i-Tech 7’s Fast Digital Imaging (FDI) solution reduced the time required for the survey by over **60%** when compared to conventional ROV based video inspection. The saved vessel days and reduced the CO2 footprint of the operation significantly.

i-Tech 7’s development of machine vision has greatly reduced the time required to manually input data and the time taken to process and deliver the data to clients. The reduced data volume speeds up traditional processing times and reduces the number of personnel required offshore.

**Summary**

- Faster data acquisition and reporting delivery
- Reduced onshore reporting costs
- Introduction of automated survey data processing
- Early deployment of machine vision technology
- Standardised skid system deployed for flexibility and ease of transfer between vessels and regions
Case Study: **Inspection**

**High Speed, High Definition Pipeline Inspection**

**Client:** BP  
**Location:** North Sea

Automated Eventing User Interface  
Pre Launch WROV set-up  
Example Dense point cloud  
Example Mesh surface

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<th>Client</th>
<th>Description</th>
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<td>2018</td>
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ANY QUESTIONS?

CONTACT US

• Keith.Grabham@Subsea7.com