ARDI Capture

Capturing Key Details in ARDI

Overview

Abstract

This document introduces ARDIs Capture addon and covers some of the cases where it might be used.

Assumed Knowledge

None.

Who to Talk To?

For more information please contact Optrix.

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Introduction

What is Capture?

Capture is designed to help customers capture key insights around specific time-frames to help with KPI reporting, analysis and developing AI models.

These time-frames might represent anything, such as…

- Days,
- Shifts,
- Batches,
- Incidents,
- Defects,
- Sample Times, etc.

If you have an event that has a name, date or unique ID, you can use Capture to record the state of your process around that time.

Why Would I Need It?

Real world data is very rarely as neat as we'd like it to be.

Some information comes from *time-series data* – live information such as temperatures, pressures and status. This information can be very stop-start and erratic, needing logic and filtering to be captured accurately.

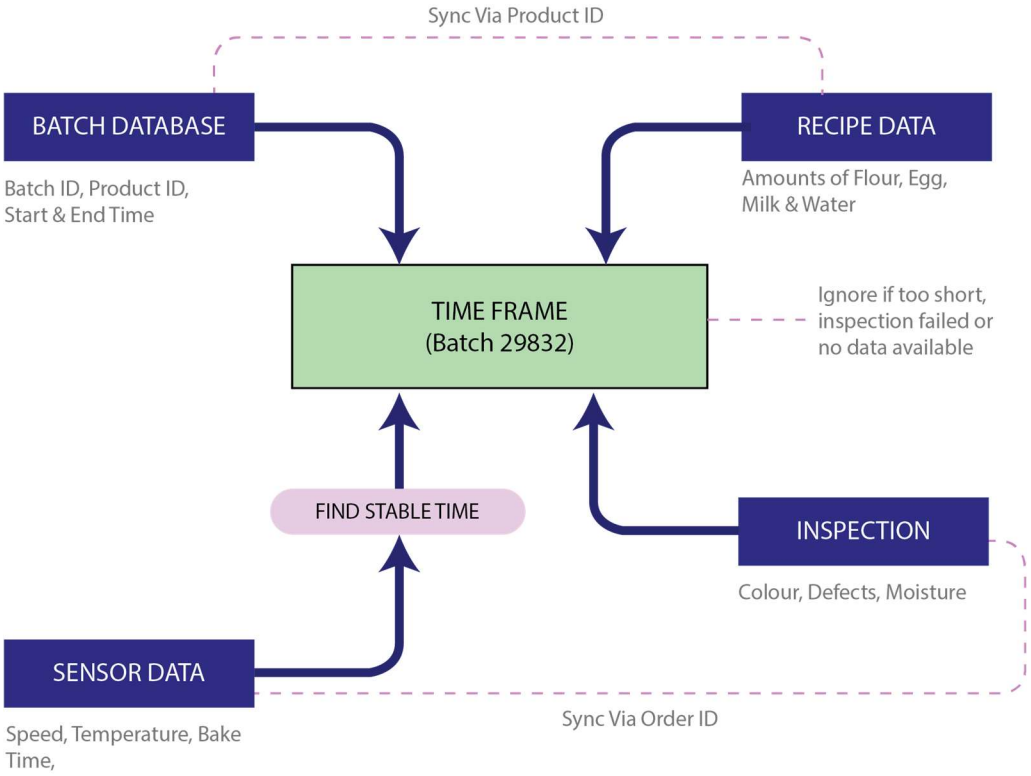
Some data comes from *events* – such as entries in a batch database - which might not have an obvious relationship with the time-series data.

Some information comes from *human entry*, and doesn't exist until well after the events that the sensors have captured have passed. These need to be synchronised.

And there's often detail that isn't available live in any system and needs to be looked up from database tables or APIs.

Looking this data up – even with a platform as flexible as ARDI – can be time-consuming, particularly if you're trying to perform reporting or analytics over long periods of time. It also often needs some knowledge of coding to create the logic to capture all of the information you need.

Capture was designed to make the whole process easier.



Capture allows you to build up *layers* of common analytics to capture information without resorting to writing a custom script.

It not only handles the process of running through the logic to capture the information about the day/batch/event, but it also **stores** that information in an easy-to-view, API-accessible database and provides a range of tools to perform searches, spot outliers and issues, compare events and build AI models.

Using Capture

Outlier Detection

Data quality isn't always perfect in real-world systems, particularly if humans make up a part of your process.

The addon includes tools to help you identify and hide *outliers* – normally errors from sensor systems or human entry – from your captured data to ensure your data is clean for use in statistical analysis or AI training.

Review & Comparison

As well as being able to view details on each individual capture, the addon includes tools that let you compare and contrast your various captured items.

This allows you to directly compare batches, days, shifts or other types of capture against one-another.

Downloads & API Access

Data can be easily downloaded with a single click, or you can access the captured information using APIs – meaning you can write your own custom scripts, reports, displays and tools that use data from the Capture system.

Trends & Display

The addon includes the ability to show trends and bar-charts of changes in values across recent history, giving you easy visual access to the information you're capturing. This is particularly useful for efficiency metrics and KPIs, allowing you to see them change over time.

Search, Matching & Modelling

For applications where you have complex machine setups, we offer several techniques to search through the captured data to find close, relevant samples in applications where you need to setup for a wide range of products and/or conditions.

Example Applications

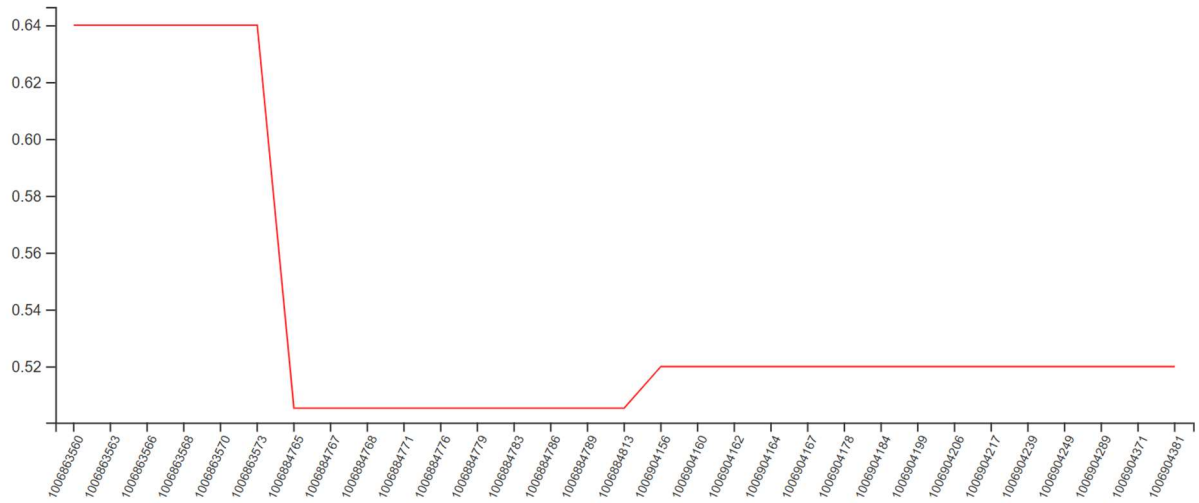
KPI Capture

At its most basic, you can use Capture to snapshot your Key Performance Indicators across your system.

By using *days* as your time-frame, it can be use to capture…

- Min, max and average values of monitoring points (weight, vibration, speed etc.)
- Total resource/energy use (ie. total gas, electricity, water consumption)
- Total amounts of production
- Usage and efficiency metrics
- Downtime & uptime metrics

Because these are automatically generated every day and recorded to a database, it's then easy to create daily, monthly or year-on-year reports using this data.



The addon includes a **trends** page where you can look at values over time to look for improvements or losses.

Virtual Sensor Creation

To make a virtual sensor, you need two types of information.

The **real world manual measurements** of the value(s) you're trying to predict, and **context information** from the parts of the process you've got real sensors on.

For instance, if you were trying to make a virtual vibration sensor for a motor, you'd need some sample vibration readings, along-side all of the information available about the motor, such as current, voltage, speed etc.

Capture allows you to create time-frames from records in a spreadsheet, so you can feed a list of measurement points and times into Capture and it will do the job of recording all of the context information into a database for easy access.

This can then be downloaded and used to train an AI model.

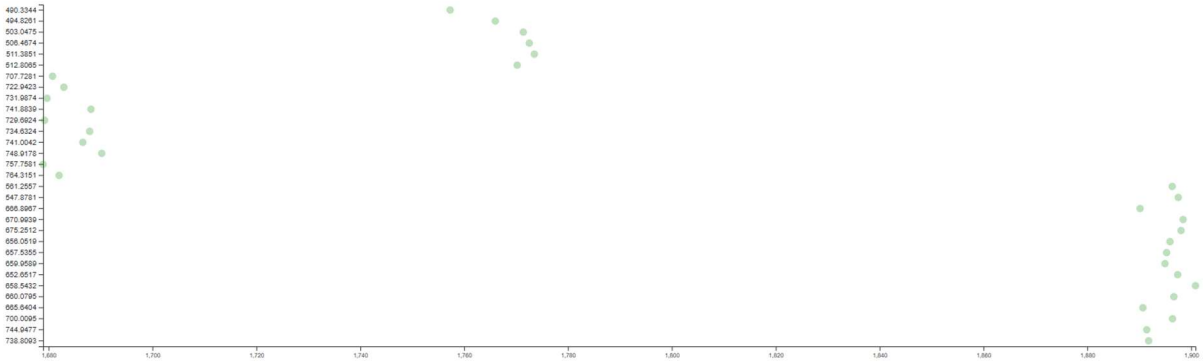
Batch Detail Capture

Capture is very useful when run on *batches*. You end up with a unique entry for every batch, and create metrics such as…

- Total run time for the batch
- Quality factors (avg speed, temperature, pressure etc.)
- Lag-corrected sensor values,
- Lookup details about the product
- Inspection results

Including *quality feedback* (ie. the inspection results) in batch captures is particularly useful.

With all of the additional detail about each batch, you may be able spot trends that wouldn't normally be visible - such as that your inspections fail more often on certain colours/styles of product, or that quality degrades when your pressures are high.



The addon includes a **compare** page where you can compare results to similar batches and look for how your different properties interact.

Machine Setup Suggestions

Capture is extremely useful if you have complex machine setups or recipes.

Some processes are simple and consistent, performing the same job every day for years with no changes.

Others have to deal with a wide range of different products, quality or type of inputs, different colours, varieties and environmental conditions.

And in those cases, it can be quite difficult to figure out how to set up your system – it's not unusual to lose significant amounts of time to uncertainty, inefficiency or trial-and-error.

Capture offers two methods of getting setup suggestions…

Fuzzy Matching

The simplest option, Fuzzy Matching searches through all of your previous Capture data to find the bet fit with your search criteria.

But the search is designed to be tuneable – you can give specific values much greater priority than others, so that the conditions that really matter take priority.

For example, if you're trying to find the ideal recipe for baking a cake based on these variables…

Size, Flavour, Filling, Icing, Decoration

…it would be sensible to prioritise **size** over all of the other factors, with **flavour** and **filling** being next, and **icing** and **decoration** being ignored completely.

Advantages

- The search results from Fuzzy Matching are always something that has been successfully done before.
- Your results tell you if the match didn't successfully match certain criteria

Disadvantages

- Fuzzy Matching isn't very useful in novel situations (ie. when working on a new type of product).

Bayesian Optimisation

Bayesian Optimisation is used to estimate the ideal *inputs* (ie. settings) that can achieve a specific outcome.

Unlike *Fuzzy Matching*, Bayesian Optimisation is able to suggest new, more refined values based on your history by trying to identify the optimal solution based on the captured data you've already collected. If you're trying to achieve a specific outcome – such as your product reaching a particular value measured by your inspections – Bayesian Optimisation is a great method.

Advantages

- Provides new, adjusted values when trying to find the ideal setup of equipment. The more sample data you have, the more optimal the solution.

Disadvantages

- Ignores complex interrelationships between assets and their properties that can be handled by AI matching,
- Doesn't work in novel situations (requires several samples that match your search criteria).
- Might suggest combinations that aren't practical or possible.
- May not be suitable when data is highly clustered.

AI Matching

AI matching uses an AI model instead of performing a search. You enter key criteria for the product you're trying to make, and the model suggests the ideal setup.

Advantages

- Runs quickly when there are large numbers of Captured records
- Results are more useful in novel/unusual situations where Fuzzy Matches might fail and Bayesian Optimisation is impossible.

Disadvantages

- Doesn't explain when you are asking for something way outside its experience,
- Only accepts a fixed set of criteria that the AI needs to be trained on.