Application Note

THRESHOLD WITH ITEMSENSE 2.0.3

V1 AND V2 ALGORITHM COMPARISON OVERVIEW

Version 1.0

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INTRODUCTION

ItemSense's threshold detection technology is designed to detect the direction of a tag's travel through a threshold. The technology also distinguishes the specific threshold of transition in use cases with multiple adjacent thresholds, such as a warehouse monitoring several adjacent dock doors.

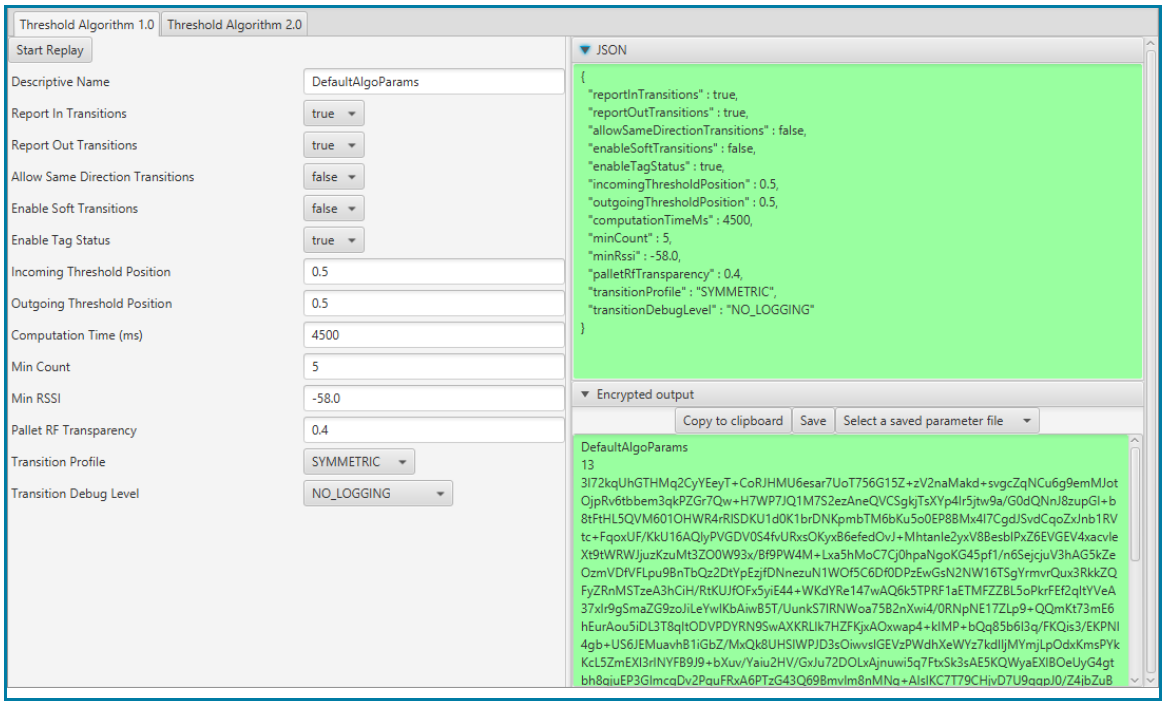
Each ItemSense update brings improvements to its algorithms, improving the reliability of threshold and the filtering stray tag reads. Newly released ItemSense version 2.0.3 introduces a new overhauled threshold algorithm while maintaining the original algorithm as a user option. The old and new algorithms are known respectively as Version 1 (V1) and Version 2 (V2).

The following application note compares the main user-facing differences between the V1 and V2 algorithms to help users identify which one will work best for their use case. ItemSense 2.0.3 and the Threshold Tuning Tool version 10.3.1 (TTT) support both V1 and V2 algorithms concurrently.

V1 ALGORITHM

The original algorithm (V1) existed for all ItemSense versions since its support of threshold events. It provides an extensive set of tuning parameters that primarily use *read count* to determine threshold events. (See Figure 1.)

Figure 1: V1 Tuning Parameters



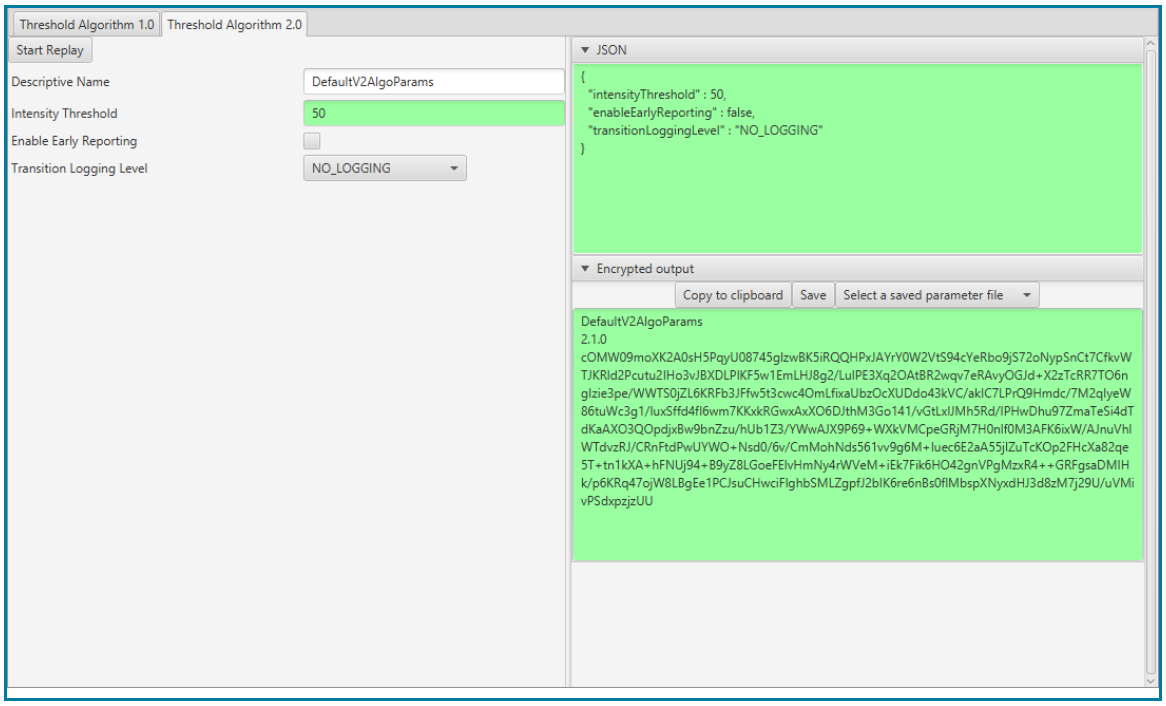
Read count is a useful metric, but it has limitations as an instrumental variable for calculating threshold activity. In some challenging environments, stray reads may distort the read count, and lower the confidence factor of the algorithm's output.

Additionally, while some customers enjoy the greater customization options, others find the complexity time consuming and unnecessary, and prefer a simpler, more automated user experience. Impinj developed the V2 algorithm as a response to these challenges.

V2 ALGORITHM

The V2 algorithm uses advanced techniques from the signal processing community and shifts from using *read count* to *read conf*, a new weighted variable calculated from both *read count* and Backscatter Signal Strength (*RSSI*). Basing V2 on *read conf* reduces the number of necessary tuning parameters to a single value that is represented in the TTT as “Intensity Threshold”. (See Figure 2.)

Figure 2: V2 Tuning Parameters



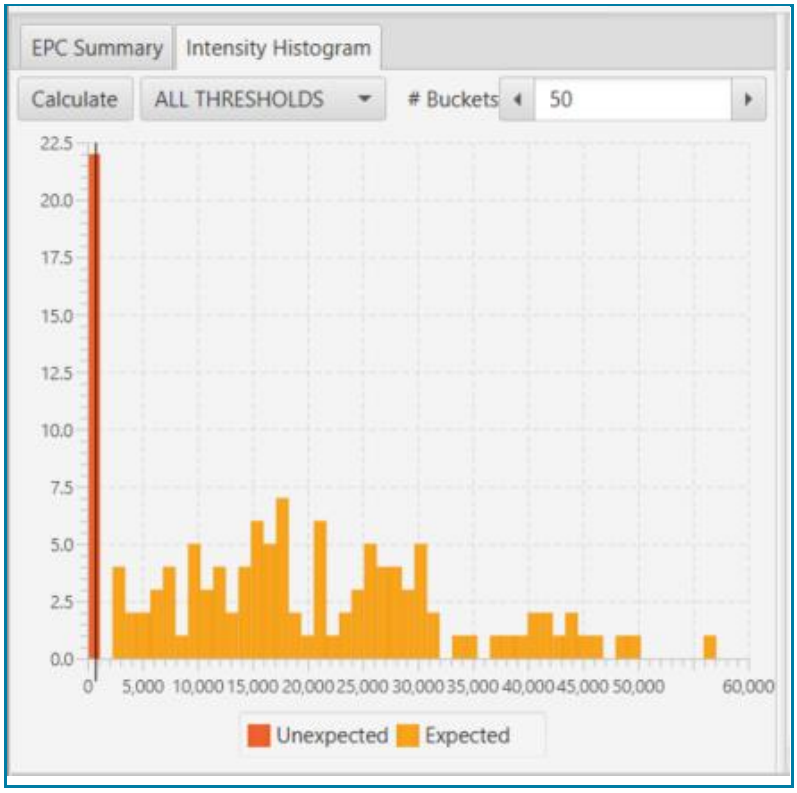
The *read conf* is calculated for each tag read, and then the algorithm sums the *read conf* values over time to generate a “signal intensity” over a period of time. Because *read conf* is based on the tag read’s RSSI, the new algorithm reduces the interference caused by stray tag reads, which usually have a lower signal strength than valid tag reads. Therefore, measuring signal intensity makes the algorithm better at discerining transition events than measuring read count alone.

THRESHOLD TUNING

Determining the best parameter settings for a threshold environment is similar for both V1 and V2. Both versions allow the user to optimize tuning parameter settings automatically by using the optimizer function built into the TTT, which compares actual threshold data against a resultset of expected transitions. Additionally, users can manually modify the tuning parameters to further tune the algorithm to better performance.

V2 also provides an additional ability to plot the histogram of tags vs. Threshold Intensity. **Error! Reference source not found.** shows the histogram feature of the TTT and how choosing the correct threshold intensity value can clearly discriminiate between valid and invalid transitioning tags.

Figure 3: Histogram – Tag Reads vs. Threshold Intensity (V2 Algorithm)



When to Use V1 vs V2 Transition Detection Algorithms

In most instances, V2 will perform as good as or better than V1. Generally, if the user is currently operating the ItemSense V1 algorithm and generating acceptable results, we recommend continuing to use V1. However, if the user is creating a new threshold, or V1 isn't generating the required results, consider using the ItemSense V2 algorithm instead.

Transition testing will determine which algorithm works better in a given us case. The ability to analyze after-the-fact data for both V1 and V2 algorithms within the same TTT permits side-by-side comparisons which will show which version of the algorithm is more accurate.

Impinj is actively collecting raw testing data from thousands of previously observed and recorded transitions. Our growing data library and continued testing ensures that we can improve to the algorithms further and continue to deliver stable, compelling results in a host of environments.

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