

Automated Assessment of Physical Capabilities

July, 2002

1. Problem

One of Plexar's clients developed a successful method for assessing the capability of a job candidate in the context of the strength requirements for the specific job. The job candidate undergoes a series of safe, isokinetic tests of major muscle groups generating a set of isokinetic torque curves. Using the result of a complex statistical analysis of the torque data, the staff technicians determine an objective numerical rating that reflects the strength capability of the worker.

The customer recognized that reducing service cost and delivery time was the key to growth. A significant impediment to automating the assessment was the complexity of the analysis. A single-pass statistical formula could not accurately rate a large percentage of the population, thereby requiring the expert staff technicians to review all tests and manually make adjustments on many of them. As a result, the throughput (and growth of the business) was constrained by the availability of the expert staff technicians. And, since the successful rating method was not documented, the company was inappropriately dependent on its expert technicians.

2. Solution

In order to increase throughput and decrease dependence on the in-house expertise, Plexar developed a rule-based algorithm to augment the statistical formula in producing a physical classification. Because the population of workers does not completely conform to any single set of rules, the algorithm also included special rules that identified certain cases as requiring human evaluation. For each test case, the algorithm produced a classification result. Along with the classification, certain cases were flagged by the algorithm as "uncertain," requiring expert review.

The rule-based algorithm completely removed the false positives (that previously were corrected by the staff experts) and, thereby, provided a 2-times increase in throughput. Also, Plexar's algorithm implementation includes a "what if" capability that easily uses historical case data to test possible new rules.

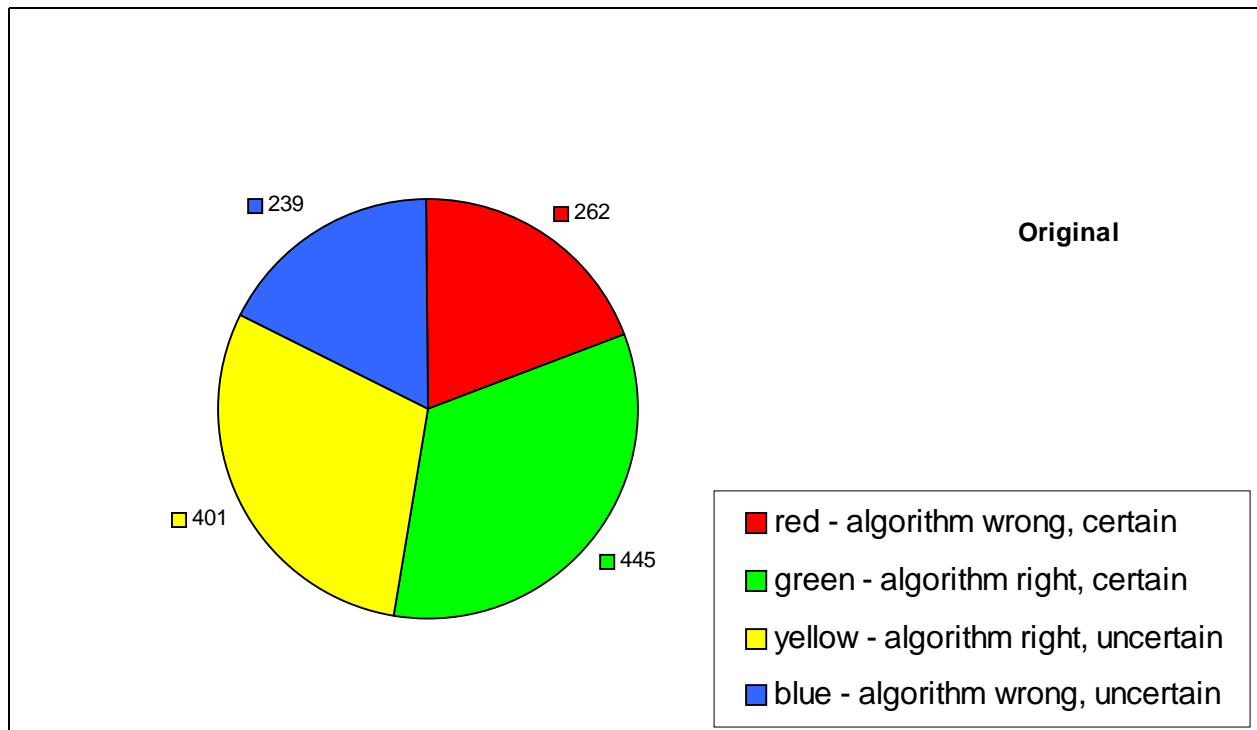
3. Results

In order to ascertain the accuracy of the algorithm, a representative set of real test cases was selected, numbering more than 1,300. For these test cases, the desired classification was known by the expert technicians and was stored in the test database. With this, at every stage of development, it was possible to score the analysis by placing each test into one of the four color-coded categories shown in the table below.

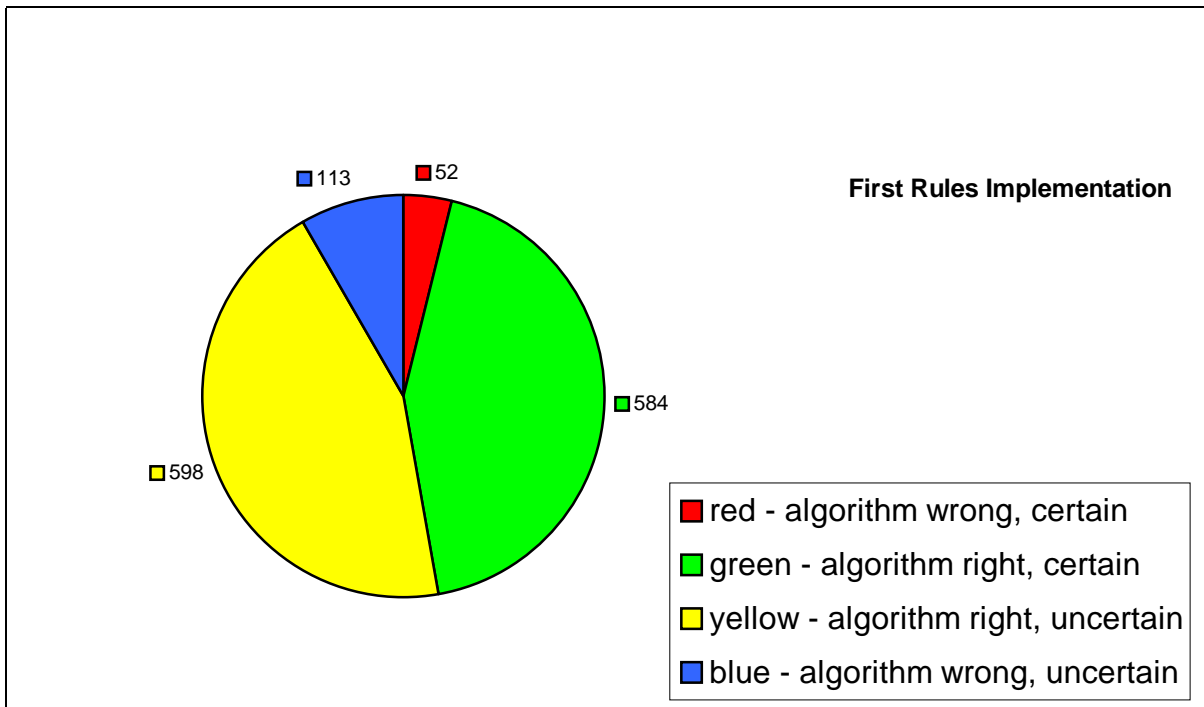
Color	Category
Green	Algorithm produced correct classification; algorithm certain
Red	Algorithm produced incorrect classification; algorithm certain
yellow	Algorithm produced correct classification; algorithm uncertain
blue	Algorithm produced incorrect classification; algorithm uncertain

Clearly, the ideal algorithm would produce only green and blue results. Red results must be absolutely eliminated. Practically speaking, it is essential to broaden the algorithm's classification of "uncertain" in order to keep the red out.

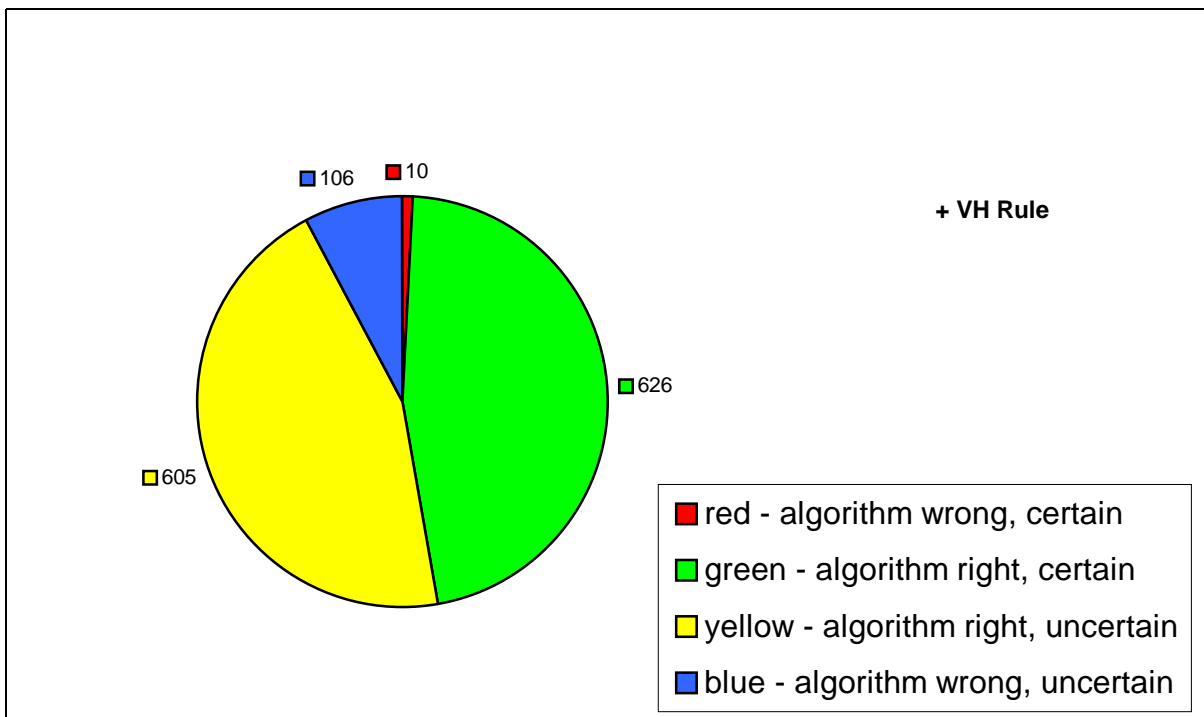
The first chart below shows the algorithm score before implementing the rules.



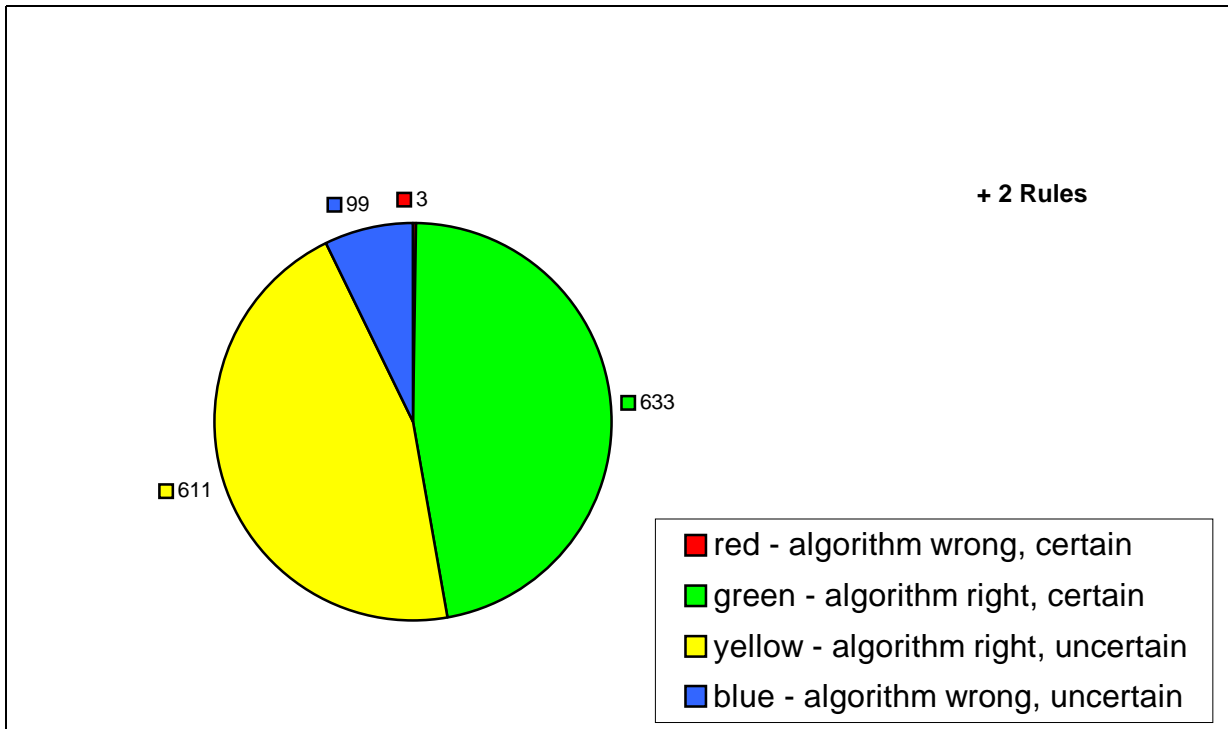
The development was done in stages as shown in the charts below. The next chart shows the result of the first rules implementation.



After the first rules implementation, Plexar focused on the red test cases and devised an additional rule that addressed a large portion of the remaining reds.



Finally, two additional rules handled some special and fairly rare case situations bringing the red down to 3 cases; the expert technicians agreed that in these three cases, the algorithm result was just as appropriate as the human assessment, so now the “red is out!”



About the author – David Rohler, Ph.D.

Dr. David Rohler is President and Founder of Plexar Associates, Inc. (started in 1987). David continues to spend the majority of his time designing products and solving technical problems for Plexar's customers. Rapid algorithm development is his forte. And he is very effective in finding and resolving impediments to project progress.