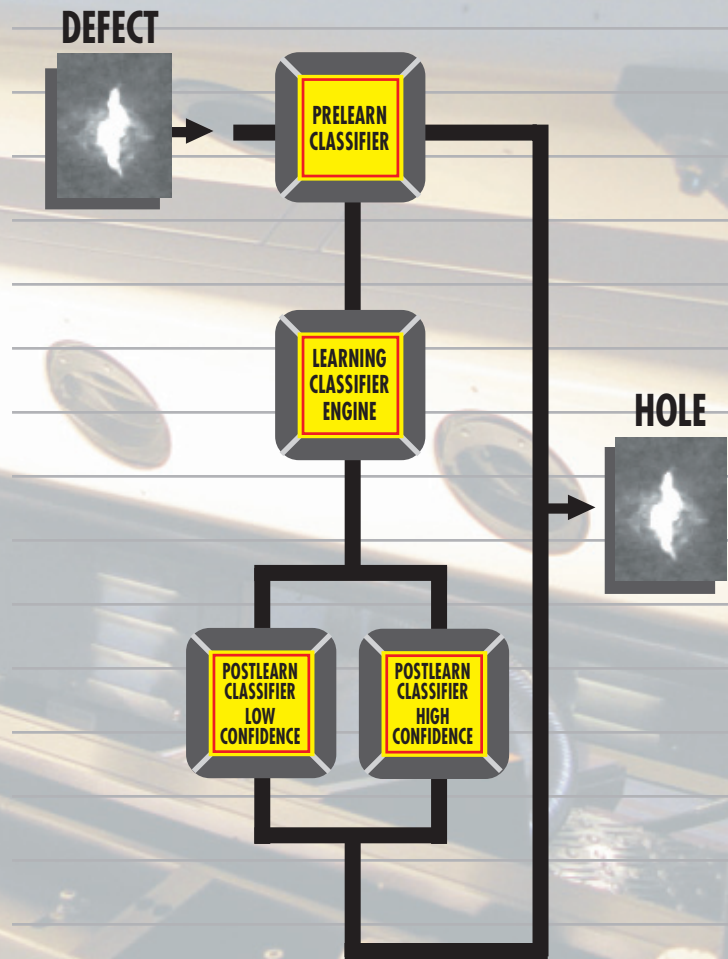


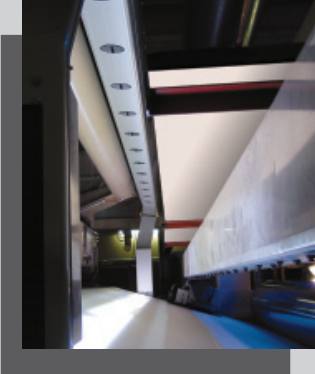


SMART LEARN™

Multi-Step Classifier

A real-time classifier for real-time decisions





Key Advantages...

- *Combines automatic learning classification with expert knowledge*
- *Choice of application-driven learning classifiers*
- *Easy drag-and-drop defect library management*
- *Simplified classification setup and maintenance*
- *Real-time classification performance for every application*

SMART LEARN™

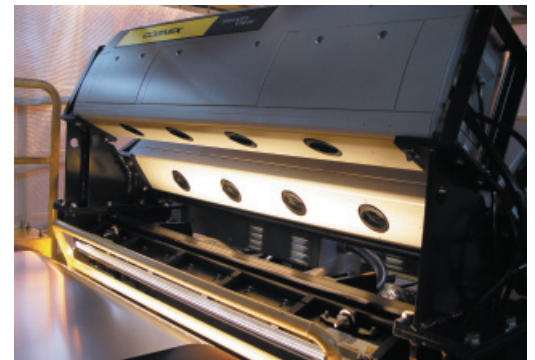
Multi-Step Classifier

A real-time classifier for real-time decisions

The SmartLearn multi-step classifier is a patented classification software tool set for Cognex® SmartView® surface inspection systems. It provides the off-line tools to set up and optimize the classifier and the distributed real-time environment to run the created classifier in SmartView camera nodes.

SmartLearn provides the flexibility to create classification schemes tailored to your particular process and requirements. Startups are now faster than ever for any application. SmartLearn dramatically improves defect classification speed and accuracy. Real-time classification performance is now a reality at any production speed.

No matter what type of surface material you are inspecting, the SmartLearn multi-step classifier maximizes the potential of your inspection system for improved product quality, higher production yield, and decreased customer returns.



SmartLearn Classification Manager

Patented, Multi-Step Classification Technology

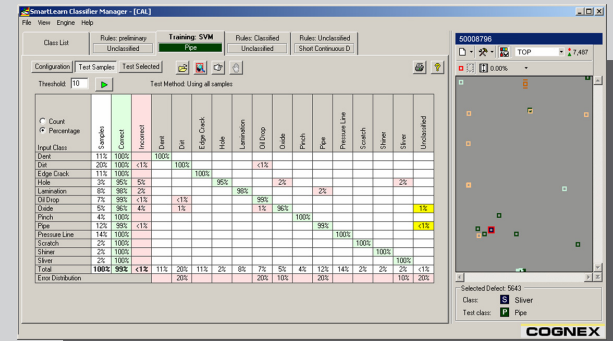
It has long been known that one single classifier cannot be optimum for every material, every process, and every production line. Furthermore, learning classifiers alone do not provide the best results. The ability to add expert knowledge to the system significantly improves the classification results.

The SmartLearn multi-step classifier is the next generation classifier system available on Cognex SmartView inspection systems. SmartLearn was designed such that the latest learning classification technology can be combined with expert knowledge of each application. SmartLearn classification delivers the best of both worlds, combining automatic, learning classification with expert knowledge in one easy-to-use, easy-to-manage software tool set. This patented multi-step classification technology enables faster startups and accurate real-time product quality assessment.

Instead of relying solely on traditional, expert-defined or learning classification, SmartLearn incorporates three distinct classification steps:

- **Preclassification** – SmartLearn prelearn classifier enables you to use expert knowledge to filter out noncritical defects or classify easily distinguishable defects. This reduces startup time and gives you immediate results.
- **Learning classification** – SmartLearn features a number of optional learning classifiers for classifying even the most complex defects. This flexible architecture enables you to choose the learning classifier that best matches the particular inspection challenges of your application.
- **Postclassification** – A postlearn classifier allows you to fine-tune classification results into specific types of defect subclasses based on any characteristics of the defect. This allows easy and reliable separation of defects that are similar but have different severities.

By incorporating a three-step approach, SmartLearn classification makes startups faster than ever. It gives you the advantage of unsurpassed accuracy and real-time classification at any production speed every day.



Versatile Classification Management

The SmartLearn Classifier Manager makes it fast and easy to set up the multi-step classification process. It provides a single tool set to use SmartView defect libraries and expert knowledge to build the most powerful defect classifier for each application.

First, it allows you to set up a rule-based prelearn classifier. This classifier can be used to classify easily definable defects without collecting a large number of sample defects. It can also be used to filter out surface features that are not defects. As soon as the prelearn classifier is defined, the multi-step classifier can be loaded to the real-time environment and used with the SmartView system. The prelearn classifier also provides an easy upgrade from previous versions of SmartView software, as the classifier used in the system works as the prelearn classifier in the multi-step classifier.

Secondly, it allows you to select the optimal learning classifier from a set of optional classifiers based on your application. No other classification tool available today allows the use of different types of learning classifiers. All optional classifiers can be trained with SmartLearn and provide 100% real-time performance in the SmartView on-line environment.

Once a learning classifier has been chosen, Classifier Manager can be used to train the classifier, test the results using defect libraries or existing inspections, and then fine-tune the classifier to further improve the classification results.

Thirdly, additional human expertise can be built into the multi-step classifier by defining two separate postlearn classifiers. One is used to catch and classify low confidence events. The other is used to accurately divide defects classified by the learning classifier into subcategories based on size, for example. This enables easy modification of the severity criteria without reteaching the learning classifier.

Superior Real-Time Classification

The SmartLearn multi-step classifier runs in the same real-time environment as defect detection. Thus, it executes the final defect classification at the same speed as the inspection is done. The SmartView system is the only system in the marketplace providing real-time classification capability. This enables real-time decision making for operators. The final classification can be fed into the mill-control system or information system in real time, not after some, *sometimes significant*, delay as with other systems.

SmartLearn Solution

Cognex offers a choice of three different learning classifiers that can be used with the SmartLearn multi-step system. The advanced SmartLearn architecture enables the integration of third-party classifiers with SmartLearn using standard Windows DLL technology. This unique architecture offers real-time classification solutions for any surface inspection problem.

- **Rule Learning Classifier** Rule Learning Classifier automatically finds a set of defect features and learns the rules to be used for defect classification. The rules are based on a set of feature values uniquely describing the defect. A Rule Learning Classifier requires the least amount of samples for each defect type. The Rule Learning Classifier is designed for applications where class separation is possible using a few unique features of the defects.

- **Statistical Classifier** When defects cannot easily be distinguished based on a few unique features, Statistical Classifier provides the next level solution. Statistical classification is done by matching the values of the features to the distribution of all features using a fast and powerful statistical algorithm. Statistical Classifier requires more samples as it uses information about the entire distribution of the feature values. The Statistical Classifier is designed specifically for applications where defect groups can be separated but the feature values overlap.

- **Support Vector Machine** When the feature values of different defect groups significantly overlap, Support Vector Machine provides the highest level solution. Support Vector Machine uses multidimensional feature space to isolate different defect groups. Support Vector Machine requires the most samples as it uses feature vectors in addition to the distribution or the range of the values. The Support Vector Machine is a powerful learning classifier designed specifically for applications where defect groups cannot seemingly be separated but still are differentiated by some combination of features.

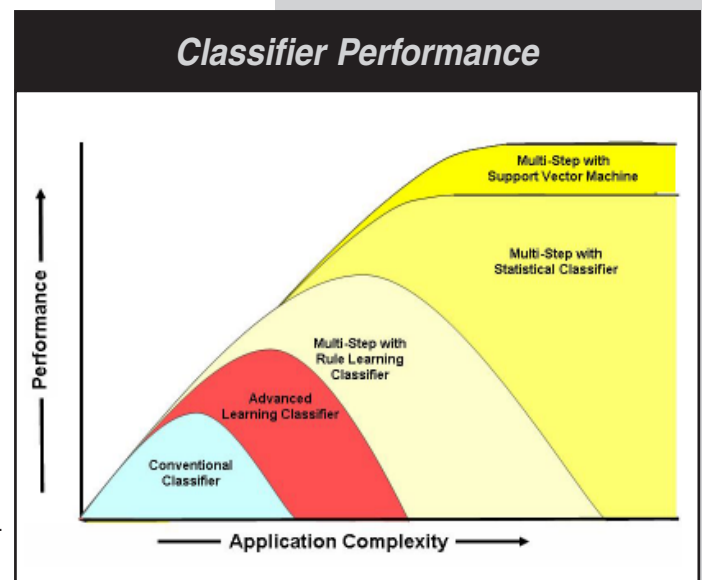
What Customers Are Saying...

“ We use the prelearn classifier mainly to filter the objects we are not interested in but need to detect. The postlearn classifier is used to assign severities such as size.”

“ You don’t have to be an expert in programming to use SmartLearn classification.”

“ It makes adding new defects fast and easy.”

“ We can easily test changes in the defect library setup and feature setup.”





Since 1981, Cognex Corporation has achieved industry leadership by focusing its expertise exclusively on vision inspection technology. The success of our surface inspection division is enhanced by Cognex's financial stability and continued commitment to Research & Development, with more than 300 vision engineers worldwide. Our network of service and support professionals has made us the world's leading supplier of machine vision systems. Our goal is to exceed our customer's expectations by providing real, lasting value through innovative surface inspection solutions. Let Cognex ensure your success and guide you through your next generation of quality improvements.

Cognex Corporation designs, develops, manufactures, and markets machine vision systems, or computers that can "see." Cognex is the world's leader in the machine vision industry, having shipped to date more than 175,000 machine vision systems, representing over \$1.3 billion in cumulative revenue, since the company's founding in 1981. Cognex's Surface Inspection Systems Division specializes in machine vision systems that are used for inspecting



the surfaces of products that are manufactured in a continuous fashion, such as metals, paper, nonwovens, and plastics. Cognex's Modular Vision Systems Division specializes in machine vision systems that are used for automating the manufacture of a wide range of discrete items and for assuring their quality. In addition to its corporate headquarters in Natick, Massachusetts, Cognex also has regional offices located throughout North America, Japan, Europe, and Southeast Asia.

About SmartView Inspection Systems

Cognex SmartView surface inspection systems ensure real-time detection, identification, and visualization of defects in paper, metals, nonwovens, and plastics during high-speed production. They enable manufacturers to reduce waste and downtime on their production lines by detecting defects early in the manufacturing process, enabling operators to take corrective action and eliminate defective material before it is sent to customers.

SmartView inspection systems also feature easy-to-configure operator interfaces, OPC and ODBC data access, and a modular architecture that allows the use of appropriate technology for the application at hand. For more information visit Cognex on-line at www.cognex.com. For more information on Cognex's Surface Inspection Systems Division products, email us at SmartView@Cognex.com.

COGNEX®

SURFACE INSPECTION SYSTEMS DIVISION

CORPORATE HEADQUARTERS:

One Vision Drive, Natick, MA 01760-2059
+508 650-4141 fax: +508 650-3344
www.cognex.com
Europe +49 721 66390 www.cognex.de
Japan +81 35977 5400 www.cognex.jp

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