FSI Machine Vision Training Programs

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Introduction to Machine Vision (Course # MVC-101)

MVC-101 is a short, basic introduction to the concepts and terminology of machine vision. It is typically run for about 30 minutes just prior to NeuroCheck / machine vision course # MVC-201, or EyeVision/ machine vision course # MVC-205.

This is a beginner course intended for persons who have had no exposure to machine vision.

Machine Vision and NeuroCheck overview (Seminar # MVC-102)

This is a 3 to 4 hour seminar which presents an introductory overview of all areas important to the success of a machine vision application from inception through long term ownership.

Includes an example project taken through inception, specification, solution, programming, startup, and long term ownership, with the specific "nuts and bolts" of each step. Plus a NeuroCheck-based technology discussion.

Machine vision equipment, technologies, tools, terminology and concepts are also covered.

Includes a description of the types of functions that machine can fulfill and accomplish, the strengths and weaknesses of machine vision and how they apply in manufacturing processes. Also includes *A Manager's Guide to Successful Machine Vision*.

Machine Vision, EyeVision and EyeSpector overview (Seminar # MVC-103)

This is a 3 to 4 hour seminar which presents an introductory overview of all areas important to the success of a machine vision application from inception through long term ownership.

Includes an example project taken through inception, specification, solution, programming, startup, and long term ownership, with the specific "nuts and bolts" of each step. Plus an EyeVision and EyeSpector based technology discussion.

Machine vision equipment, technologies, tools, terminology and concepts are also covered.

Includes a description of the types of functions that machine can fulfill and accomplish, the strengths and weaknesses of machine vision and how they apply in manufacturing processes. Also includes *A Manager's Guide to Successful Machine Vision*.

Machine Vision & NeuroCheck Technical Training Course (#MVC-201)

This is our main and most popular NeuroCheck® course, which covers how to do automatic inspection applications using NeuroCheck-powered machine vision. This is a 1 2/3 day, "industrial strength" non-commercial course. Commonly used topics are covered in greater depth, and the more advanced or specialized topics are covered as overviews. There is substantial focus on the use of NeuroCheck software, and highly condensed sections cover other areas that are crucial to project success. Topics include:

- Brief general overview of machine vision technologies, architectures, evolution and purposes.
- An overview and framework for successful machine vision project implementation. Strategies for mission and application definition that successfully fulfills the mission while avoiding unnecessary cost escalation. Feasibility studies, application review, review of scope questions and related implementation, and project management.
- Basic setup and navigation of NeuroCheck® software for implementing machine vision applications.
- NeuroCheck® software tools and their use, including image acquisition, asynchronous image acquisition, using NeuroCheck® 's 54 standard filters or custom filters for image processing, creating / applying look-up tables to images, image thresholding, defining, processing, sorting, screening, counting regions of Interest, template matching, thresholding, bar code reading, deriving object-level mathematical results (elsewhere), gauging color processing, Neural Net color classifications, Neural Net processor use, and Neural Classifier use. Creating and passing results of checks as ROI objects, image-level math, and other tools.
- Other NeuroCheck® system features which are utilized for machine vision applications. Password and multi-level security profiles. Creating and exporting spreadsheets and other output files and data, networking, Check Routine Wizards, operating modes (manual, test, live and automatic) and their uses. Configuring the user interface / automatic mode screen. Use of XML self-documentation capabilities.
- Brief introduction to Plug-Ins, and NeuroCheck Plug-In capabilities. If requested in advance, a section on how to install, enable and access plug-ins will be added.
- Implementation of example machine vision applications: Presence verification to check for proper assembly and forming of parts, character recognition, print quality inspection, robot guidance, pattern recognition, gauging, color analysis, surface analysis, and flaw detection.
- Overview of principles and implementation concepts for triggering, and high-speed image acquisition. Overview parallel processing. If requested in advance, a detailed section on parallel processing is added.

- The 4 methods of discrete I/O control: global, check level, tool level and combining flow control with I/O tool insertions.
- NeuroCheck software & license media and administration.
- Introduction to NeuroCheck capabilities for unusual (non-default) program flow control, including non-sequential passage/linkage of input and output objects from and to tools, and conditional branching.
- Hardware overview of machine vision systems powered by NeuroCheck. Includes various approaches utilizing FSI pre-tested systems and pre-tested building blocks where compatibility issues have already been resolved. Overview of relevant image acquisition / camera specifications and selection including resolution, speed, and comparison of performance and operational characteristics of monochromatic, color and line-scan image acquisition. Brief overview of image acquisition, I/O hardware functions, plant-floor enclosure ratings, and relevant specifications.
- Machine vision lighting purposes, principles and implementation. This briefly distills and covers the key points of this important and extensive topic. It covers the objectives of machine vision lighting, and how they are often the opposite of just "lighting it up". Next is an introduction to the fundamental illumination scenarios, their uses and how they are created. This includes the geometry of the workpiece, the imaging equipment and the lighting equipment, and the geometric relationship between these three. Review of types of light sources that are inside lighting products, and the types and terminology of lighting products. Finally, examples are given which combine all of the above principles.
- Machine Vision lens types and selection. Standard and specialized lenses. Brief overview of this extensive topic.

An extensive notebook, NeuroCheck CD, and a training course CD with example images, problems and solutions are provided to each participant.

The duration of the MV-201 course is 1 ¾ days.

FSI Solution Provider Course (Course #MVC-202)

This is a 2 day course which covers NeuroCheck and EyeVision software, the most heavily used tools and features of those software engines, core machine vision concepts, and topics related to the FSI & FSI Solution Provider team effort.   Prerequisite: FSI Solution Provider agreement

Hands-On & Specialized-Topic NeuroCheck Training (Course #MVC-204)

This is a ¾ day course with hands-on NeuroCheck programming practice for approximately 10 basic applications. Includes extra coverage of those areas that are of greatest interest to the attendees. Also includes practice on other aspects of setup. Pre-requisites are MVC-201 and for full hands-on participation, a notebook computer with a CD drive; otherwise partial hands-on participation is still available.

A NeuroCheck CD, and a training course CD with example images, problems and solutions are provided to each participant.

EyeVision and Machine Vision Technical Training Course (Course # MVC-205)

This is the Primary EyeVision software course. It covers all of the commonly used aspects and tools of the EyeVision software in all factory built vision units (EyeSpector and PowerEye). Basic universal EyeSpector and PowerEye hardware aspects are also covered, as well as a

condensed overview of other topics crucial to machine vision success (including lighting design and optics). This is a 1 ½ day course

This is our main and most popular EyeVision course, which covers how to do automatic inspection applications using EyeVision-powered machine vision, including EyeSpector smart cameras and PowerEye vision systems. This is a 12 hour (1 ½ day) "industrial strength" non-commercial course. Commonly used topics are covered in greater depth, and the more advanced or specialized topics are covered as overviews. There is substantial focus on the use of EyeVision software, and highly condensed sections cover other areas that are crucial to project success. Topics include:

- Brief general overview of machine vision technologies, architectures, evolution and purposes.
- An overview and framework for successful machine vision project implementation. Strategies for mission and application definition that successfully fulfills the mission while avoiding unnecessary cost escalation. Feasibility studies, application review, review of scope questions and related implementation, and project management.
- Basic setup and navigation of EyeVision® software for implementing machine vision applications.
- EyeVision® software tools and their use, including image acquisition, asynchronous image acquisition, using EyeVision® 's standard filters or custom filters for image processing, image thresholding, defining, processing, sorting, screening, counting regions of Interest, template matching, thresholding, bar code reading, deriving object-level mathematical results (elsewhere), gauging color processing, and color classifications. Creating and passing results of tools as objects, image-level math, and other tools.
- Other EyeVision® system features which are utilized for machine vision applications. Creating and exporting output files and data, networking.
- Implementation of example machine vision applications: Presence verification to check for proper assembly and forming of parts, character recognition, print quality inspection, robot guidance, pattern recognition, gauging, color analysis, surface analysis, and flaw detection.
- Overview of principles and implementation concepts for triggering, and high-speed image acquisition. Overview parallel processing. If requested in advance, a detailed section on parallel processing is added.
- The methods of discrete I/O control.
- EyeVision® software & license media and administration.
- Introduction to EyeVision® capabilities for unusual program flow control, including non-sequential passage/linkage of input and output objects from and to tools, sub-routines and conditional branching.
- Hardware overview of machine vision systems powered by EyeVision® Includes EyeSpector smart cameras and various approaches utilizing FSI pre-tested systems and pre-tested building blocks where compatibility issues have already been resolved. Overview of relevant image acquisition / camera specifications and selection including resolution, speed, and comparison of performance and operational characteristics of monochromatic, color and line-scan image acquisition. Brief overview of image acquisition, I/O hardware functions, plant-floor enclosure ratings, and relevant specifications.

- Machine vision lighting purposes, principles and implementation. This briefly distills and covers the key points of this important and extensive topic. It covers the objectives of machine vision lighting, and how they are often the opposite of just "lighting it up". Next is an introduction to the fundamental illumination scenarios, their uses and how they are created. This includes the geometry of the workpiece, the imaging equipment and the lighting equipment, and the geometric relationship between these three. Review of types of light sources that are inside lighting products, and the types and terminology of lighting products. Finally, examples are given which combine all of the above principles.
- Machine Vision lens types and selection. Standard and specialized lenses. Brief overview of this extensive topic.

An extensive notebook, EyeVision® CD, and a training course CD with example images, problems and solutions are provided to each participant.

The duration of the MV-205 course is 1 ½ days

EyeVision Course #2 MVC-206

This course covers the special and more complex EyeVision tools (relating to factory built units) which were not covered in MVC-205. This is a ½ day course.

Hands on EyeVision Practice MVC-218

Hands on EyeVision practice using approximately 10 basic applications. Includes extra coverage of those areas that are of greatest interest to the attendees. Also includes practice on other aspects of setup. Pre-requisites are MVC-205 and (for full hands-on participation) a notebook computer with a CD drive. ¾ day course.

Industrial Machine Vision Course 221   (#MVC-221)

This covers the diverse technical and project management fields crucial to successful machine vision.   Machine vision principles, practices, programming, systems, hardware, software, applications, implementation, technologies, physics, and project management. This is a 1 ¾ day course with sections on each area important to successful machine vision, with modules that distill each of theses areas.

- Overview of machine vision system architectures, configuration and terminology.
- Objectives, Principles and Engineering of machine vision lighting. Machine vision lighting purposes, principles and implementation. This briefly distills and covers the key points of this important and extensive topic. It covers the objectives of machine vision lighting, and how they are often the opposite of just "lighting it up". Next is an introduction to the fundamental illumination scenarios, their uses and how they are created. This includes the geometry of the workpiece, the imaging equipment and the lighting equipment, and the geometric relationship between these three. Review of types of light sources that are inside lighting products, and the types and terminology of lighting products. Finally, examples are given which combine all of the above principles.
- Machine Vision Light Sources   Strengths, weaknesses, terminology and application parameters of machine vision light sources.
- Lenses and Optics Purpose, principles, types, specifications and selection.

- "A Manager's Guide to Successful Machine Vision" . Covers project inception through successful long term ownership. This covers the "secrets" of the FSI "Assured Path to Success" roadmap which has double the success rate of machine vision applications from 50% to 100%. This includes development of an application specification optimized to reduce cost while accomplishing the require mission. It covers effective methods and sequencing of the other steps including selection of equipment and technologies, creation of the physical and programming solutions, testing and hardening, and documentation and planning for successful long term ownership.

- Machine vision software and programming. This section uses two software engines (NeuroCheck and EyeVision) to provide visuals and specifics in all of the covered areas. This covers inspection program and image processing tools and methods such as gauging (including high accuracy edge modeling, static and dynamic calibration, gauging rules) color analysis, neural net processing and classification, , image transformations and filtering, gauging, image calibration, gauging tools, bar code and data-matrix reading, OCR, OCV, edge detection algorithms, re-sampling, print quality inspection, sub-pixeling resolution, robot guidance, surface analysis, template matching, "location" programming for inspection of product where the position and orientation varies, unrolling images. System level programming function such as GUI's, discrete and data I/O, security, effective software, image and programming documentation, image storage for troubleshooting triggered applications, running and programming operating modes, reference images. Program architecture including program flow and passage of parameters.

- Adaptation to the full range of line speeds using (where needed) direct hardware triggering, strobe synchronization and parallel processing.

- Imaging and imaging resolution. Introduction imaging parameters and technologies. Progressive, interlaced, rolling, area and line scan imaging processer covered. Gray scale, single and three chip color imaging. Brief coverage of imaging outside of the visible band including near-IR, IR, UV, UV florescence, and X-Ray. Introduction to spatial and array resolution. .

- Adaptation to factory floor conditions.

- Introduction to false rejects in automatic inspection systems. Analysis, including the relationship with zero defect automatic inspection. Strategies and specification.

- Machine Vision accuracy and how to achieve it. Begins with a framework which dispels common misconceptions.

- Machine Vision Software and Programming.

The course does not cover the manufacture of machine vision units and systems. Nor does it cover lower (library and code) level machine vision programming.

Hands on Remote NeuroCheck or EyeVision Practice MVC-223

Supervised, structured remote practice on NeuroCheck and/or Eye Vision.   Pre-requisites: MVC-201 for NeuroCheck or MVC-205 for EyeVision.

Principles, Methods and Technologies of Machine Vision Lighting   Course # MVC-230

This is a 1 day (8 hour) course covering the purposes and objectives of machine vision lighting, the underlying physics and engineering concepts for design of machine vision lighting solutions, as well as common machine vision methods, equipment and technologies.

NeuroCheck Plug-In Course (#MVC-291)

This is a 2 day course.
Content:
>   Creation of Plug-ins
>   Utilization of Already-Developed Plug-Ins

Pre-requisites:
>   Completion of MVC-201
>   Fluent on writing DLL's with C++ (only a brief review of key areas on this is included)
>   Instructor approval (based on above 2 items)
>   Bring Notebook computer with C++ loaded, and CD ROM drive

Suggested / Popular Courses for NeuroCheck-Powered Machine Vision Training

The most common and popular way to obtain NeuroCheck training is to take course # MVC-201, and (often) to follow it by MVC-204.

Suggested / Popular Courses for EyeVision and EyeSpector-Powered Machine Vision Training

The most common and popular way to obtain EyeVision and EyeSpector training is to take course # MVC-205, and (often) to follow it by MVC-218.

On-Site Machine Vision, NeuroCheck or Application-Specific Training

Ask us for a quotation for on-site training. Customization is available for the cost of the required advanced work.

Course Schedule

Course			
MVC-101	*	*	*
MVC-102	**	**	**
MVC-103	**	**	**
MVC-201	**8/13/14-8/14/14**	**11/5/14-11/6/14**	**2/4/15-2/5/15**
MVC-202	**	**	**
MVC-204	**8/14/14-8/15/14**	**11/6/14-11/7/14**	**2/5/15-2/6/15**
MVC-205	**10/5/14-10/6/14**	**2/11/15-2/12/15**	**6/10/15-6/11/15**
MVC-206	**	**	**
MVC-221	**	**	**
MVC-230	**	**	**
MVC-218	**10/6/14-10/7/14**	**2/12/15-2/13/15**	**6/11/15-6/12/15**
MVC-291	November 2014**	April 2015**	November 2015**

* Available on the first day of each MVC-201 and MVC-205 course.

** Please contact FSI for scheduling

Registration & Details

Please contact your FSI Machine Vision representative or FSI for detailed pricing and registration information. Here is a general overview:

Each course has a minimum (typically 3) and maximum number of attendees. If the minimum number has not registered by 25 days before the course, the course is not held, and all registrants are notified immediately and offered several options including a full refund and also (except for MVC-291) a shorter condensed version for the same price. The deadline for signup is 1 week before the course, but we strongly encourage you to sign up much earlier to help assure that the class will be held. Sign-up is via a purchase order and pre-payment. There is a charge for late cancellations, including cancellations on free classes.

Overview of pricing:

- MVC-101, MVC-102 & MVC-103 are free.
- MVC-201, MVC-202 MVC-204, MVC-205, MVC-206, MVC-218, MVC-221 and MVC-230 are economically priced.
- MVC-291 is a specialized course with substantially higher pricing.
- On-site training is quoted based on your requirements.