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## Specification for ENVI - Image Processing Software

### Basic Information of the Image Processing Software:

<b>Platform Type</b>	Desktop Based
<b>Name of the Software</b>	ENVI
<b>Name of the OEM</b>	L3Harris Geo-spatial
<b>Version of the Software</b>	5.5.2
<b>Date of launch of version</b>	June, 2019
<b>No. of Days Training Provided at Site</b>	0-5 Days
<b>No. of years upto Support (Warranty) is available from OEM/Distributor</b>	1 Year

### Supported Hardware Requirements Parameters:

<b>Hard Disk Space Required</b>	10 GB for install (1TB day-2-day use)
<b>64 Bit Support</b>	Both, 64 bit and 32 bit (Classic)
<b>OS Platform Supported</b>	Windows, Linux, Macintosh (Refer support page)
<b>RAM Memory</b>	8 GB (Min), 16 GB (recommended)
<b>Video RAM</b>	1 GB (Min) with OpenGL 2.0 Support

### General Requirements Parameters:

<b>Maximum user handling capability</b>	1 license 1 user
<b>Concurrent user handling capability</b>	Yes
<b>Type of licensing</b>	User based, Concurrent, perpetual
<b>Lab Kit \ Bundle available</b>	Yes
<b>Software supplied through</b>	Media & URL Links
<b>List of items included in the package</b>	ENVI Software
<b>Free upgrades to higher version within Support (Warranty) period</b>	Yes

## Features of Imager Processing Software:

Sr. No	Functionality \ Features available
1	<p><b>Software should support the below mentioned rasters and vectors:</b></p> <p>DPPDB, ECRG, GRIB-1, GRIB-2, HDF5, IAS, JPEG, JPIP, LAS, HDF4, Multi-page TIFF, NetCDF-4 DIMAP V2, USGS SDTS DEM, XWD, CADRG, CIB, DTED, ENVI raster, ER Mapper, IMG, Esri® Enterprise Geodatabase (.sde), GeoTIFF, JPEG2000, PCI, TIFF, Sensor Support: Cartosat, IRS (fast &amp; super structure), ResourceSat-1 (Fast &amp; Super Structured), ResourceSat-2 (HDF5), Deimos-1 &amp; 2, Gaofen-1, UK-DMC 1/ 2, DMC ALSAT-1, ENVISAT AATSR/ MERIS, EO-1 ALI (HDF4), DubaiSat-1 (RAW) &amp; 2, Landsat 8 (OLI &amp; TIRS), Landsat NLAPS, Landsat MRLC, RASAT, NPP VIIRS, Proba-V, TIMS, Sentinel-2, SkySat-1 &amp; 2, Google Skybox, Ziyuan-1-02C &amp; 3A, SeaWiFS, QuickBird, Worldview 1–2 &amp; 3, VNREDSat-1, , Beijing-1, NigeriaSat-1 &amp; 2, GeoEye, IKONOS. Video formats: Adobe Flash (f4v, flv), SWF, GIF, MOV, AVI, Google WebM Matroska (WEBM), Matroska Video (mkv), Motion JPEG (mjpeg, mjpg), Motion JPEG2000 (mj2), MPEG (mpeg, mpg, mp1, m2v, ts, mp2, mpg2, mpeg2, mpv, m2v, 3gp, 3g2, h264, mp4, mpeg4, mpg4)</p>
2	<p><b>Classification:</b></p> <p>Adaptive Coherence Estimator (ACE), Constrained Energy Minimization (CEM), Decision Trees, Independent Components Analysis (ICA), Orthogonal Subspace Projection (OSP), Mixture Tuned Target-Constrained Interference - Minimized Filter (MTTCIMF), Supervised Classifications: Binary Encoding, Maximum Likelihood, Spectral Information Divergence (SID), Support Vector Machine (SVM), TERCAT (Terrain Categorization), Target- Constrained Interference-Minimized Filter (TCIMF), Post Classification Analysis: Kappa Coefficient, Confusion Matrix, Class Statistics, Receiver Operating Characteristic (ROC) Curves: Find Optimal Classification Thresholds, Receiver Operating Characteristic (ROC) Curves: Decrease False Classifications</p>
3	<p><b>Hyperspectral Analysis:</b></p> <p>Sensor Support: AISA, ARTEMIS (with license), AVIRIS, CASI, HyMap, Hyperion, HyperScan, HySpex, MIVIS, PROBE-1, Analysis: Tactical Hyperspectral Operations Resource (THOR) workflows (Anomaly Detection, Atmospheric Correction, LOCs - Water and Trails, Stressed Vegetation, Target Detection, Stressed Vegetation, Material Identification) Minimum Noise Fraction (MNF), Pixel Purity Index (PPI), Automated Corner Clustering in N-D Scatter Plot, N-Dimensional Visualizer, Spectral Library: ASTER, JPL, USGS, IGCP, Import new versions of the above libraries. Classifications: Spectral Angel Mapper (SAM), Spectral Feature Fitting ( SFF), ACE, CEM, SVM, Matched Filtering, Mixture Tuned Matched Filtering. Continuum removal.</p>
4	<p><b>Mathematics &amp; Statistics</b></p> <p>Auto correlation, Band Math and Spectral Math: Boolean Operators, Trigonometric Functions, Data Type Conversion Functions, Relational Operators. Correlograms, Image statistics: Band Minimum, Maximum, Mean, Standard, Co variance Matrix, Correlation Matrix, Eigenvectors, Semivariograms</p>

5	<p><b>Transformation:</b></p> <p>Adaptive Coherence Estimator (ACE), Decorrelation Stretch, Forward and Inverse Independent Components Analysis (ICA), Forward and Inverse Minimum Noise Fraction (MNF), PCA, Inbuilt Band Ratio:Burn Area Index, Clay Minerals Ratio, Ferrous Minerals Ratio, Iron Oxide Ratio, Normalized Burn Ratio, Normalized Burn Difference, World View Soil Index, Ligning index, Anthorcyenin index</p>
6	<p><b>Pre - processing &amp; Calibration</b></p> <p>Apply Gain &amp; Offset, Bad Band Identification, Bad Line Replacement, Bad Pixel Replacement, Cross-Track Illumination Correction, Dark Subtraction, Destripe Data, Empirical Line Calibration, ERS and Radarsat Data Calibration, Emissivity calculation, Flat Field Calibration, Ignore Pixel Value, Internal Average Relative Reflectance correction, Calibration, Log Residuals, MODIS Bowtie Correction, Thermal Atmospheric Correction</p>
7	<p><b>Registration &amp; RPC Ortho-rectification:</b></p> <ul style="list-style-type: none"> <li>• Image-to-Map &amp; Image -to-Image Registration</li> <li>• Interactive/Automatic Ground Control Point Generation</li> <li>• Sub pixel Ground Control Point Location</li> <li>• Automatic Geo referencing: ASTER, AVHRR, AATSR, ASAR, MERIS, MODIS, Radarsat, SeaWiFS, SPOT, Cosmo-SkyMed</li> <li>• Ortho rectification (RPCs): Aerial Photographs (Digital and Frame), ASTER, CARTOSAT-1, Generic Pushbroom Sensors, IKONOS, OrbView-3, GeoEye-1, Worldview, FORMOSAT-2, Kompsat-2, Quickbird, SPOT 1-5, RapidEye</li> <li>• Replacement Sensor Model(RSM)</li> <li>• Guided Workflow for Ortho rectification(RPCs)</li> <li>• Rotated Projections</li> <li>• Warping Methods: Delaunay Triangulation, Polynomial, Rotation, Scaling, Translation (RST)</li> <li>• Support more than 55 projections</li> <li>• Support more than 45 spheroids and 200 datum's</li> <li>• Capabilities to add more spheroids and datum's</li> </ul>
8	<p><b>RADAR Analysis:</b></p> <p>Sensor Support: AIRSAR, ALOS-1 and -2 PALSAR, COSMO-SkyMed, ENVISAT ASAR, ERS-1, ERS-2, JERS-1, RADARSAT-1, RADARSAT-2, SICD, SIR-C / X-SAR, TOPSAR Correlation Image, Speckle Filters:, Frost, Enhanced Frost, Gamma, Kuan, Lee, Enhanced Lee, Local Sigma, Bit Error. Antenna Pattern Correction, AIRSAR Scattering Mechanism Classifier, CEOS Tape Reading, Convert integrated TOPSAR to: C-band VV data, Correlation image, DEM, Incident Angle image, L- and P-band polarimetric AIRSAR Data, Multi-Look SIR-C Data, Polarization Signatures from ROIs &amp; Single Pixels, Sigma nought and Beta nought from ERS, Slant-to-Ground Range Conversion, Synthetic Color Image</p>
9	<p><b>LIDAR Data Processing :</b></p> <p>Visualize, Analyze, and manage your point clouds, Allow you to view point clouds in 2D,3D; Style points by return, elevation, intensity, Create high resolution topographic surface, Viewer for LIDAR data, Increase or decrease Z-scale</p>

10	<p><b>Topographic Analysis:</b></p> <p>Associate DEM with Image, Calculate Slope and Aspect Images, Shaded Relief Image, Line-of-Sight (View shed) Analysis, Topographic Measures: Convexity, Plan Convexity, Longitudinal Convexity, Cross Sectional convexity, Minimum Curvature, Maximum Curvature, Three-Dimensional Visualization, Topographic Feature Extraction (Classification): Ridge, Channel, Plane, Peak, Pit; Animated 360° 3D Visualization, Drape Image Over 3-D Surface, Fly through, Output Fly-Through Sequence to MPEG, VRML 2.0</p>
11	<p><b>Vector GIS Functionalities:</b></p> <p>Drag/Drop ArcGIS Layers, ArcGIS Layer Attribute Viewing, Attributes: Create, Edit, Query Vector Attributes, Import from ArcView Shape files, ASCII, Burn-in Vectors on Raster Image, Import from ArcGIS Geo Database, Save Vectors to ArcGIS Geo Database, Vector to Raster Conversion</p>
12	<p><b>Visualization options:</b></p> <p>Support for files over 2 GB in size, Geographic linking &amp; Sync Views, Dynamic North Arrow &amp; Scale Bar, Geo- Point tool, image histogram modification tools, Filtering for thematic images (Neighborhood Analysis), Visual change detection between any data types, Swipe / Blend / Flicker/ Portal, Inquire cursor and inquire box, including MGRS support, Interpolation techniques: linear or non-linear rubber sheeting, Create an unlimited number of JPEG2000 compressed images from input images with either export or direct-write.</p>
13	<p><b>Operating System Support:</b></p> <ul style="list-style-type: none"> <li>• Windows 7, 8, 10 (Intel/ AMD 64bit)</li> <li>• Macintosh (Intel 64 bit)) 10.9,10.10</li> <li>• Linux Kernel 2.6.32, glibc 2.12 (Intel/AMD64-bit)</li> </ul>
14	<p><b>Spectral Indices</b></p> <p><b><i>vegetation indices:</i></b></p> <ul style="list-style-type: none"> <li>▪ Difference Vegetation Index</li> <li>▪ Global Environmental Monitoring Index</li> <li>▪ Green Atmospherically Resistant Index</li> <li>▪ Green Difference Vegetation Index</li> <li>▪ Green Normalized Difference Vegetation Index</li> <li>▪ Green Ratio Vegetation Index</li> <li>▪ Green Vegetation Index</li> <li>▪ Infrared Percentage Vegetation Index</li> <li>▪ Leaf Area Index</li> <li>▪ Modified Chlorophyll Absorption Ratio Index</li> <li>▪ Modified Chlorophyll Absorption Ratio Index -Improved</li> <li>▪ Modified Non-Linear Index</li> <li>▪ Modified Simple Ratio</li> <li>▪ Modified Triangular Vegetation Index</li> <li>▪ Modified Triangular Vegetation Index -Improved</li> <li>▪ Non-Linear Index</li> <li>▪ Normalized Difference Water Index</li> <li>▪ Normalized Multi-band Drought Index</li> <li>▪ Optimized Soil Adjusted Vegetation Index</li> <li>▪ Red Green Ratio Index</li> </ul>

	<ul style="list-style-type: none"> <li>▪ Renormalized Difference Vegetation Index</li> <li>▪ Soil Adjusted Vegetation Index</li> <li>▪ Simple Ratio</li> <li>▪ Transformed Chlorophyll Absorption Reflectance Index</li> <li>▪ Transformed Difference Vegetation Index</li> <li>▪ Triangular Vegetation Index</li> <li>▪ Visible Atmospherically Resistant Index</li> <li>▪ World View Improved Vegetative Index(WV-VI)</li> </ul>
15	<p><b>Other Indices Available:</b></p> <ul style="list-style-type: none"> <li>▪ Burn Area Index Clay Minerals Ratio</li> <li>▪ Ferrous Minerals Ratio</li> <li>▪ Iron Oxide Ratio</li> <li>▪ Normalized Burn Ratio</li> <li>▪ Normalized Burn Ratio Thermal1</li> <li>▪ Normalized Difference Built-Up Index</li> <li>▪ Normalized Difference Snow Index</li> <li>▪ World View Built-Up Index</li> <li>▪ World View New Iron Index</li> <li>▪ World View Non- Homogenous Feature Difference</li> <li>▪ World View Soil Index</li> </ul>
16	<p><b>GPU enabled algorithms:</b></p> <p>High Speed Ortho rectification,  High-Speed Quick Atmospheric Correction (HSQUAC), High-Speed Principal Component Analysis (HSPCA),  High-Speed Adaptive Coherence Estimator (HSACE)</p>

