



BrainVision Analyzer 2

RELEASE NOTES



Software

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BrainVision Analyzer version 2.2.0 (May 2019)

What's new

Average	<ul style="list-style-type: none">▶ Source code has been ported to .NET and the transformations have been completely rewritten. [a] Note: Previous Vision 1 Average nodes will persist in history trees and templates after Analyzer 2.2.0 is installed. These nodes may contain issues. Use Troubleshooting to detect these nodes and exchange them with the new version of Average by calling the transform anew from the ribbon.▶ New user interface with improved GUI validations to assure the integrity of used parameters. Computations are done in double precision with a new algorithm used to compute Standard Deviation to improve performance. [a]▶ A new property 'BrainVision.ChannelAveragedSegments' was introduced to store the actual number of segments which have been used for averaging for each particular channel (option Individual Channel mode is ON). This information will be used by Grand Average. [a]
Grand Average	<ul style="list-style-type: none">▶ New user interface with an improved validation of input parameters. The new GUI options provide a more flexible option to display and select history files. Backward compatibility with GUI parameters and *.agav files has been maintained. [b]▶ Number of contributing input nodes and segments are now stored in the new channel properties BrainVision.ChannelAveragedNodes and BrainVision.ChannelAveragedSegments. [b]
EGI Reader	<ul style="list-style-type: none">▶ EGI reader has been fully redesigned and ported to .NET. [f]▶ The new reader supports both continuous, segmented and averaged EGI simple binary format (*.raw) with integer precision (format versions 2 and 3) and floating-point single precision (format versions 4 and 5). The new EGI reader also achieves a higher precision of EEG voltage values by supporting the additional channel gain (*.Gain) and zero (*.Zero) files that comes along with the *.raw file. Both files shall have the same names, and shall be located in the same directory as the *.raw files. [f]▶ The new EGI Reader provides a possibility to define for each EGI amplifier its corresponding peak-to-peak value with the help of the configuration *.xml file. Each *.raw file shall be accompanied by its configuration file. The configuration file shall have the same name as the .raw file and shall be placed in the same folder. If no configuration file is used, the EGI reader takes the default value (5000 microvolts). Note: In order to create a configuration file, copy the configuration file EGIReaderConfiguration.xml.template from the Analyzer installation folder (default path: C:\Vision\Analyzer2) to the Raw File folder. Enter the peak-to-peak value for the corresponding *.raw EGI data and rename the file as the *.raw data file. [f]

What's new

Color Maps	<ul style="list-style-type: none"> ▶ Data visualization options for 2D and 3D topographic maps, connectivity graphs and time-frequency views have been enhanced with the introduction of the new Brainbow, Maretierra, Plasma, and Paruly color maps.
Coherence	<ul style="list-style-type: none"> ▶ The Coherence transform can now be applied to input data in the time, frequency and time-frequency domain. [g]
Time-frequency View	<ul style="list-style-type: none"> ▶ Connectivity graphs generated by transforms Coherence, Correlation Measures and Cross-Correlation can also display in the right lower corner of the time-frequency view. [h]
Correlation Measures	<ul style="list-style-type: none"> ▶ A new connectivity transform Correlation Measures has been included in the Comparison and Statistics group. It supports several connectivity measures in the time, frequency and time-frequency domain. [i] Note: The Vision 1 Covariance transform has been excluded from the Analyzer ribbon, and will not be further developed and supported. However, Covariance nodes will persist in history trees and templates after Analyzer 2.2.0 is installed. These nodes may contain issues. Use Troubleshooting to detect Covariance nodes and exchange them with nodes created with the new Correlation Measures transform.
Troubleshooting	<ul style="list-style-type: none"> ▶ A new Add In, Troubleshooting, has been introduced in the group Diagnostics. It can scan/diagnose existing workspaces, history trees and history nodes. Troubleshooting contains a set of predefined tests to detect automatically data integrity problems, inconsistencies or wrong settings. In addition, it conveniently reports detected issues in a customizable format and proposes potential solutions.
Wavelets	<ul style="list-style-type: none"> ▶ When running time-frequency analysis with the Morlet Complex wavelet, four new output value options have been added to further explore power and phase dynamics. The set of node properties has been extended accordingly to reflect the new set of output values. [m] ▶ Two new normalization options (Percent Change and Decibel) have been added. [m]
Cross-Correlation	<ul style="list-style-type: none"> ▶ The new version of Cross-Correlation has been completely redesigned. It supports new cross-covariance and cross-correlation measures in the time and frequency domain. [n]

What's new

ERS/ERD	<ul style="list-style-type: none">▶ Source code has been ported to the .NET platform. Time-frequency input data is no longer supported. New options has been included to compute log-transformed power values and normalized power changes in decibels. A new property BrainVision.ChannelAveragedSegments has been introduced to store the actual number of segments which have been used for averaging for each particular channel (option Individual Channel mode is ON). This information will be used by Grand Average. Note: Previous Vision 1 ERS/ERD nodes will persist in history trees and templates after Analyzer 2.2.0 is installed. These nodes may contain issues. Use Troubleshooting to detect these nodes and exchange them with the new version of ERS/ERD by calling the transform anew from the ribbon. [o]▶ The GUI has been fully redesigned to improve usability. It makes use of the standard GUI controls for segment selection and definition of the reference interval. [o]▶ A new smoothing procedure has been introduced with the option Moving Average, which increases the statistical reliability of the ERS/ERD output values. [o]
Complex Demodulation	<ul style="list-style-type: none">▶ Calling the transform in automation mode has been disabled. [h]▶ The Source code has been ported to the .NET platform. New options have been included to compute amplitude and power envelope as well as the instantaneous (wrapped) phase of the signal. [h] Note: Previous Vision 1 Complex Demodulation nodes will persist in history trees and templates after Analyzer 2.2.0 is installed. These nodes may contain issues. Use Troubleshooting to detect these nodes and exchange them with the new version of Complex Demodulation by calling the transform anew from the ribbon.

Comprehensive

The following effect the complete Analyzer software package.

Application Suite	<ul style="list-style-type: none">▶ Brain Products Application Suite is now available on USB.
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Comprehensive

<p>Unsupported Conditions</p>	<ul style="list-style-type: none"> ▶ Data integrity problems such as empty, untrimmed and duplicate channel names as well as duplicate head channel coordinates may lead to severe data processing failures. In Analyzer 2.2.0, if these unsupported conditions are detected either in parent node or in template parameters, execution is aborted in all processing modes, i.e. when calling modules from the ribbon, when reprocessing or copying a node, or during automatic data analysis using history templates. Proper validation of these unsupported conditions has been introduced in the following modules: <ul style="list-style-type: none"> ▶ IIR Filters - validation of channels names. ▶ Linear Derivation - validation of channels names. ▶ Topographic Interpolation - validation of channel names and coordinates. ▶ CSD - validation of channel coordinates. ▶ Coherence - validation of channels names. ▶ Correlation Measures - validation of channels names. ▶ Cross-Correlation - validation of channel names. <p>Note: Please note that these unsupported conditions were previously tolerated. Therefore, several existing history trees and templates may be affected by these issues. In this case, reprocessing/copying of affected history trees and application of affected templates will be aborted until these issues are resolved. Use the Troubleshooting Add In to scan history trees and detect nodes affected by these issues. Use Edit Channels transform to correct channel names and coordinates.</p>
<p>Connectivity Graph File</p>	<ul style="list-style-type: none"> ▶ A new BrainVision Graph Files (*.bvgraph) has been introduced. It contains the definition of channel pairs within a connectivity graph. It can be created and imported by connectivity transforms Coherence, Correlation Measures and Cross-Correlation.

Enhancements

The following enhancements were made for this release.

<p>Analyzer Ribbon</p>	<ul style="list-style-type: none"> ▶ The transforms Edit Markers and New Reference have been moved to the Dataset Preprocessing group. ▶ The transforms Formula Evaluator and Linear Derivation have been moved to the Channel Preprocessing subgroup in the Dataset Preprocessing group. ▶ The transforms ERS/ERD and Complex Demodulation have been moved to the Frequency and Component Analysis group.
<p>Average</p>	<ul style="list-style-type: none"> ▶ An improved mathematical formula for the computation of the SNR. [a] ▶ Considerable enhancement of Operation Infos to better describe the used parameters and include detailed information of the underlying calculations. [a]

Enhancements

Grand Average	<ul style="list-style-type: none"> ▶ Improved mechanisms for the identification of the reference history file, data aggregation when Individual Channel Mode option is on or off, and the correct matching of input nodes, channels and units. More restrictive conditions for selection of valid nodes and channels were implemented to assure integrity of output data: the new version rejects input data channels with Bad Interval markers and Invalid Data markers, excludes input nodes with untrimmed names or containing more than one segment, and discard input data with empty and duplicate channel names. [b] Note: these restrictive conditions may lead to backward compatibility and different numerical results because of a higher rate of channels and nodes exclusion. ▶ Operation Infos better describe the parameters used and the underlying calculations. Including detailed information about reference node, included and excluded nodes, amount of segments contributing to the grand average per channel, reasons for node exclusion and warnings on issues affecting the input data. [b]
IIR Filters	<ul style="list-style-type: none"> ▶ The Time Constant [s] is now displayed in the GUI and is no longer editable. It is updated whenever a valid Low Cutoff Frequency [Hz] value is input. [c] ▶ The validations of valid input frequency parameters was improved both in GUI and template mode. [c] ▶ The calculation of filter coefficients was extracted to a math library and the numerical computation was improved. [c] ▶ In previous versions of the IIR Filters transform, if it was applied on demand, the requested data interval for the calculation was extended equally across all channels, even if individual channel mode was on. This may lead to inconsistencies when the filter settings are different across channels. In the new version the calculation was improved, and intervals are requested individually for each channel based on the filter settings. [c] ▶ The computation of the transient length in IIR Filters has been improved and takes into account the Order of the filter. It leads to more accurate output data. [c] ▶ The numerical computation of effective cutoff frequencies was improved by adopting higher precision of internal constant values. [c] Note: This improvement takes effect on nodes which are created with the new version of Analyzer. IIR Filters nodes that have already been created with the option "Store Data in Cache File" selected are not automatically updated and need to be reprocessed after installing Analyzer 2.2.0.
Color Maps	<ul style="list-style-type: none"> ▶ The Standard color map produced an over-representation of values close to zero in green shades. This has been improved and is now replaced by the new Brainbow color map. ▶ The user interface of the View Settings has been improved and standardized across all views. A Color Map preview has been added. ▶ For all 2D views displaying topographic maps, the default value of the options Use Preview and Quick Graphics has been set to false (options are not selected). It will provide a better resolution image. In contrast, selecting these options will provide quicker rendering with lower resolution.

Enhancements

Coherence	▶ GUI has been completely redesigned. It includes new options for the automatic selection of channel pairs and the creation of custom connectivity networks. [g]
	▶ Numerical precision of calculations has been improved. [g]
Time-frequency View	▶ Topographic maps and connectivity graphs in the right lower corner of the time-frequency view displays both the time and frequency position as selected by a mouse click.
Linear Derivation	▶ If new data is computed for existing channels, they preserve all their properties, including their coordinates. [k]
Topographic Interpolation	▶ Inconsistent data units of head channels in input data are no longer supported. All input head channels shall have the same unit. [l]
	▶ Inconsistent reference of head channels in input data are no longer supported. All input head channels shall have the same reference channel. [l]
3D Head View	▶ The 3D heads (Adam, Anna, Liza, and Baby) have been replaced by new versions which have a 4x denser mesh in the scalp area. This change entails a smoother distribution of the data on the head surface, and a homogeneous visual experience of light/shading effects across the four heads.
Wavelets	▶ Reference intervals used for normalization and baseline correction are properly adjusted when applying the Wavelets transform in template mode. If the target node does not provide the requested reference interval, execution is aborted. Interval adjustment is reported in Operation Infos. [m]
	▶ Previously three GUI controls were used to select a reference interval for each normalization option. In the new version of Wavelets, they have been merged into one, based on the new standard GUI control for definition of the reference interval. [m]
	▶ If the Continuous Wavelets Transform is applied to continuous or segmented data (Manual or based on Start/End makers), it now computes the time-frequency data on demand on an extended interval as long as the borders of the segment are not overshoot. In this way, analysis pipelines including caching or not of wavelet nodes lead to identical results. No reprocess of the node is needed for this improvement to take place. [m]
	▶ Previously the normalization options Normed Output and Baseline Correction could be combined. In the new version, this combination has been exchanged by the new normalization option Percent Change. If old wavelets nodes are reprocessed or applied in template mode, the new normalization option Percent Change will be applied instead. [m] Note that the resulting numerical output data may differ from the previous ones.
Cross-Correlation	▶ GUI and Operation Infos have been completely redesigned. The GUI includes new options for the automatic selection of channel pairs and the creation of custom connectivity networks. When applied to input data in the frequency domain, it makes use of the new standard GUI interval control for the selection of a frequency band. [n]

Enhancements

Views	<ul style="list-style-type: none"> ▶ Visual representation of spectral data has been enhanced. Spectral values can now be plotted for both positive and negative frequencies. This feature is needed when computing Cross-Correlation in the frequency domain, i.e. for negative frequency lags.
ERS/ERD	<ul style="list-style-type: none"> ▶ In case all channels are affected by bad interval markers across all segments, then no node is created. This avoids the creation of nodes with invalid data. [o]
	<ul style="list-style-type: none"> ▶ Improved IIR filtering operations by usage of the new standard filter mathlib. [o]
Complex Demodulation	<ul style="list-style-type: none"> ▶ Improved IIR filtering operations by usage of the new standard filter mathlib. [h]
	<ul style="list-style-type: none"> ▶ The GUI has been fully redesigned to improve usability. [h]

Critical Issues

The following issues were fixed for this release.

Grand Average	<ul style="list-style-type: none"> ▶ In case the number of segments contributing to the input average nodes were different for each channel, previous versions of Grand Average lead to incorrect calculation of Weighted Grand Average and Weighted Standard Deviation. This has been resolved. Weighted Grand Average and Weighted Standard Deviation are now computed correctly for each channel by enabling the Weighted values checkbox. [b]
EKG Reader	<ul style="list-style-type: none"> ▶ For specific EKG data parameters, the previous version of the reader was not able to properly read the data and did not create a raw data node. With the new reader the correct numerical data is read and displayed as a new raw data node. [f]
FFT Inverse	<ul style="list-style-type: none"> ▶ In case FFT was applied to data segmented with respect to a marker, Time Zero markers were not restored by the FFT Inverse transform and the segmentation type was incorrectly set to Fixed Time instead of Marker. This issue led to the incorrect visualization of the resulting time domain data after application of the FFT Inverse transform. Besides, further data processing steps which depend on the position of the Time Zero markers could lead to incorrect data. This issue has been resolved, i.e. both the segmentation type and Time Zero markers are properly restored. [e] <p>Note: After installing the new version of Analyzer, the FFT Inverse node shall be reprocessed to restore the TimeZero markers. If other transforms applied below the FFT Inverse node make use of Time Zero markers (e.g. Baseline Correction), then the newly reprocessed FFT Inverse node may result in different (but correct) numerical values.</p>
Topographic Interpolation	<ul style="list-style-type: none"> ▶ If a posterior midline new channel (e.g. between Pz and Oz) was selected from the Map for interpolation in Free Coordinate Selection mode, then the interpolated data was not computed based on the spherical coordinates of the new channel. Both the interpolated data and the coordinates of the newly created channel were incorrect. This data relevant issue has been resolved, i.e. coordinates and data of the new channel are correctly computed. [i]

Critical Issues

Wavelets	<ul style="list-style-type: none"> ▶ Previously the computation of the Continuous Wavelets Transform based on one frequency layer only led to incorrect numerical results. This issue has been corrected, i.e. the wavelet results based on one frequency layer are identical to the corresponding output values when multiple layers are computed. [m] ▶ Previously the normalization option Normed Output was based on the sum of absolute values in the reference interval, leading to incorrect numerical results. This issue has been corrected, i.e., the Normed Output is now based on the mean of absolute values in the reference interval. [m] ▶ In previous versions of the Inverse Wavelets Transform, output data was unavailable and a view error was displayed. This happened when navigating along zoomed-in segments containing multiple channels. This has now been resolved. [m]
Segmentation	<ul style="list-style-type: none"> ▶ In previous versions of Segmentation based on Start/End Markers, incorrect segments were extracted if a New Segment marker was placed between a Start and a subsequent Start marker, i.e. the marker sequence (Start - New Segment - Start) was present in the input data. This issue has been corrected in the new version of Segmentation.

Corrected

The following were corrected for this release.

Average	<ul style="list-style-type: none"> ▶ An issue with the value stored in the property 'BrainVision.AveragedSegments', when the option Individual Channel Mode was used, has been corrected. The correct value is the smallest number of segments which go into the calculations. [a] ▶ Compared to previous versions, if each channel has in each segment a "Bad Interval" marker, then no new Average node is created (because all channels of the Average node have invalid data). [a]
IIR Filters	<ul style="list-style-type: none"> ▶ In previous versions of IIR Filters, if the option Enable Individual Channel Filters was used, channel-specific Notch frequencies in the table were ignored in some situations. This issue has been resolved and channel-specific Notch frequencies are now considered in the computations. [c] ▶ Previously the computation of effective cutoff frequencies for the zero-phase shift Notch filter was not correct. This issue has been resolved, resulting in a bandwidth of exactly 5 Hz. [c] Note: This correction takes effect on nodes which are created with the new version of Analyzer. IIR Filters nodes that have already been created with the option "Store Data in Cache File" selected are not automatically updated and need to be reprocessed after installing Analyzer 2.2.0.

Corrected

FFT	<ul style="list-style-type: none">▶ Bad interval markers in FFT data were incorrectly displayed if the option "Draw Data as Block" in the View Settings was selected. This issue has now been resolved. [d]▶ Handling of units in FFT output data has been corrected. In particular, when FFT data was normalized by the total area of the spectrum within a given frequency range, the output data unit was incorrect. This issue has now been corrected. i.e. the unit has been set to %. [d]
Color Maps	<ul style="list-style-type: none">▶ Under specific conditions, the Custom Colors map wrongly mapped zero values. Besides, either positive or negative values were mapped, while the other half was set to zero. These issues have been corrected and values are properly displayed by the Custom Color maps.▶ Under specific conditions, the color range of the BrownScaling color map was inverted. This issue has been corrected. The BrownScaling color map has been replaced by the new Maretierra color map.
Coherence	<ul style="list-style-type: none">▶ Masking of coherence values for frequencies where signal energy is very small has been corrected, based on a better epsilon-based criterion. [g]
Edit Channels	<ul style="list-style-type: none">▶ If a channel is deselected, the full row in the table is disabled and grayed out.▶ Handling of modified channel positions while the node is reprocessed has been corrected. [j]▶ The behavior of the button "Select All/Deselect All" has been corrected. If all channels are deselected, the state of the button is "Select All". If all channels are selected, the state of the button is "Deselect All". [j]
Linear Derivation	<ul style="list-style-type: none">▶ If input data had channel units different from μV, the output data units could be incorrect in certain situations. Now data unit of existing and new channels are set correctly. [k]
Wavelets	<ul style="list-style-type: none">▶ When running time-frequency analysis with the Morlet Complex wavelet, the option Squared Wavelet Coefficients has been deprecated and is not available in the GUI anymore. Its usage is not recommended in this context. [m] Note: If old wavelets nodes using this option are applied in template node, the option will still be applied. Reprocess of the wavelets will automatically change the selected option to Wavelet Coefficients - Complex Values.

Corrected

Cross-Correlation	<ul style="list-style-type: none"> ▶ Previously the module averaged the output data across segments and cached its result in the history node. The new version computes the output data on demand for each segment. Average across segments shall be subsequently performed with the Average transform. [n] <i>Backward compatibility issues:</i> <ul style="list-style-type: none"> ▶ Averaged data is not automatically computed any longer. Thus, reprocess/copy or template application of an old Cross-Correlation node may lead to issues for children nodes which expects averaged data. ▶ Channel pair names have been changed in the new version. Thus, reprocess/copy or template application of an old Cross-Correlation node may lead to error in child nodes that use channel names as parameters. ▶ Complex input data is no longer supported. Therefore, if an old Cross-Correlation node was applied on complex data, and is reprocessed/copied or applied in template mode, then Analyzer 2.2.0 validations will stop execution. ▶ As previously created nodes will persist in history trees after Analyzer 2.2.0 is installed, it is recommended to use Troubleshooting to detect these nodes and exchange them with the new version of Cross-Correlation by calling the transform anew from the ribbon.
Views	<ul style="list-style-type: none"> ▶ When using some transient views (Mapping View, CSD Map, 3D Head View and Channel Pairs View) on manual and fixed-time segments (excluding the start of the data), the display of the time interval in the legend of the transient views was not consistent with the same interval as displayed in the "Select Area Settings...". This issue has been corrected. ▶ Previously time-frequency views displayed units inconsistently in the color bar and frequency domain satellite plot. This issue has been corrected, and units are now consistent.
Complex Demodulation	<ul style="list-style-type: none"> ▶ In contrast to the previous version, newly created nodes are called Complex Demodulation, independently of the used option. [h] Note that this may lead to backward compatibility issues in template mode. ▶ Computation of instantaneous amplitude, power, and (wrapped) phase are based on a new algorithm. It leads to different (but correct) numerical results with respect to previous versions. [h]

Known Issues

The following known issues could not be addressed in this release.

EGI Reader	<ul style="list-style-type: none"> ▶ The new EGI reader does not support anymore behavioral (*.behav) and Multiple Raw (MRF) files. This may lead to inconsistencies when reading existing MRF files in the workspace. [f]
Linear Derivation	<ul style="list-style-type: none"> ▶ When selecting an entire row by clicking on the first column, copying and pasting of the row content leads to an unhandled error and the copied content will be incorrect. [k]

Module Information

The following includes new or updated modules which are part of this release. The Ref. will be added when an update or issue relates to a specific module.

Ref.	Module name	Filename	Version
a	Average	Average.dll	2.2.07326
b	Grand Average	GrandAverage.dll	2.2.0.7360
c	IIR Filters	Filters.dll	2.2.0.7341
d	FFT	FFT.dll	2.2.0.7327
e	FFT Inverse	FFTInverse.dll	2.2.0.7328
f	EGL Reader	EGLReader.dll	2.2.0.7363
g	Coherence	Coherence.dll	2.2.0.7330
h	Complex Demodulation	ComplexDemodulation.dll	2.2.0.7342
i	Correlation Measures	CorrelationMeasures.dll	2.2.0.7332
j	Edit Channels	EditChannels.dll	2.2.0.7359
k	Linear Derivation	LinearDerivation.dll	2.2.0.7355
l	Topographic Interpolation	TopographicInterpolation.dll	2.2.0.7357
m	Wavelets	Wavelets2.dll	2.2.0.7358
n	Cross-Correlation	CrossCorrelation.dll	2.2.0.7333
o	ERS/ERD	ERSERD .dll	2.2.0.7329



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