

PIAAA: Reliable And Cost-Effective Phantom Images Analysis

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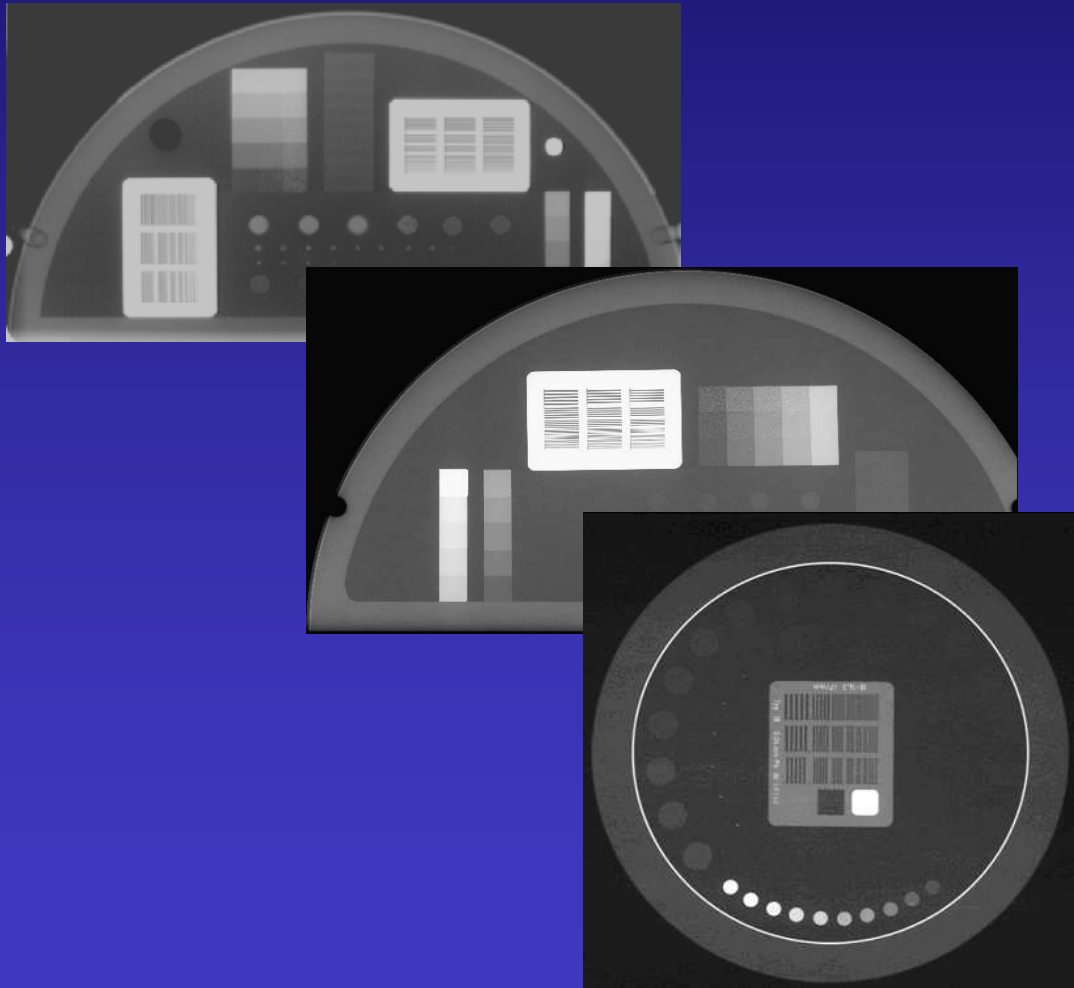
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Measuring Quality Is Comparing Image Quality Indices (IQIs)



- Measuring Imaging Systems (ISs) quality mainly has two goals
 - Ensure ISs deliver best quality images
 - Determine the relationships between exposure parameters and image quality
- In both scenarios it is a matter of comparing IQIs
 - Actual values with those produced when the system performed at its best
 - Those obtained under different exposure conditions

Test Objects Provide a Controlled Framework



- Exposed object shall not influence IQIs
 - Differences in IQIs shall be the effects of changes in the imaging system
- Exposed objects shall contain details that highlight image quality features
- Test objects have been studied and developed to achieve this goals

IQIs Can Be Evaluated Manually by a Human Observer



- Human observer's scores consist in
 - Counting "visible" details
 - Measuring densities (or mean grey levels for digital images)

Unreliable and Subjective Estimations that Cost a Lot



- Manual observation is inherently
 - Subjective
 - Sensitive to intra- and inter-reader variability
 - Time consuming
 - The less time and effort are invested the worse the results
- Therefore the estimation of the IS quality may be
 - Costly
 - Unreliable
 - Questionable

Automatic Analysis Delivers Better Results

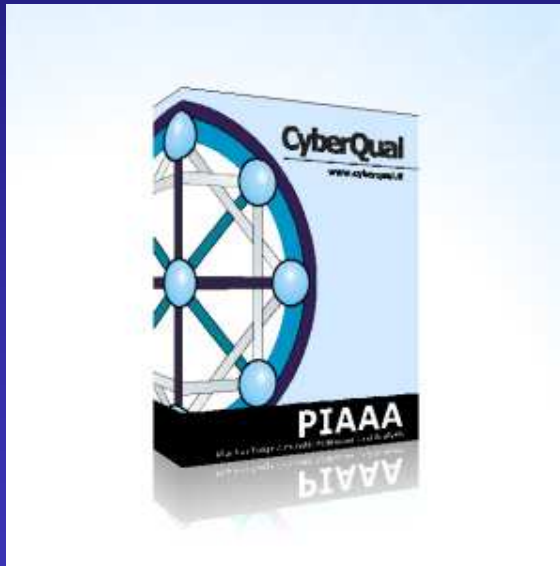


- On the contrary, automatically calculating IQIs is
 - Economical (the computer is faster and cheaper than humans)
 - Effective (it is more sensitive and precise)
 - Objective (it needs no human judgement)
 - Reproducible (it always produces the same result)
- This is suggested by many scientific publications

Some Scientific Publications about Automatic Analysis

- G. Gennaro, F. Ferro, G. Contento, F. Fornasin and C. di Maggio
Automated analysis of phantom images for the evaluation of long-term reproducibility in digital mammography
Phys. Med. Biol. 52, 1387-1407 (2007)
- J. Trueblood, G. David, K. Kearfott and J. Peng
"Objective evaluation of ACR mammography accreditation phantom images"
Proceedings of SCAR 92, p.265-271 (1992)
- D.P. Chakraborty and M. Eckert
"Quantitative versus subjective evaluation of mammography accreditation phantom images"
Med. Phys. 22, 133-143 (1994)
- A.D. Castellano Smith, I.A. Castellano Smith and D.R. Dance
"Objective assessment of phantom image quality in mammography: a feasibility study"
Br. J. Radiol. 71, 48-59 (1998)
- P. Mayo, F. Rodenas, G. Verdù, J.I. Villaescusa and J.M. Campayo
"Automatic evaluation of the image quality of a mammographic phantom"

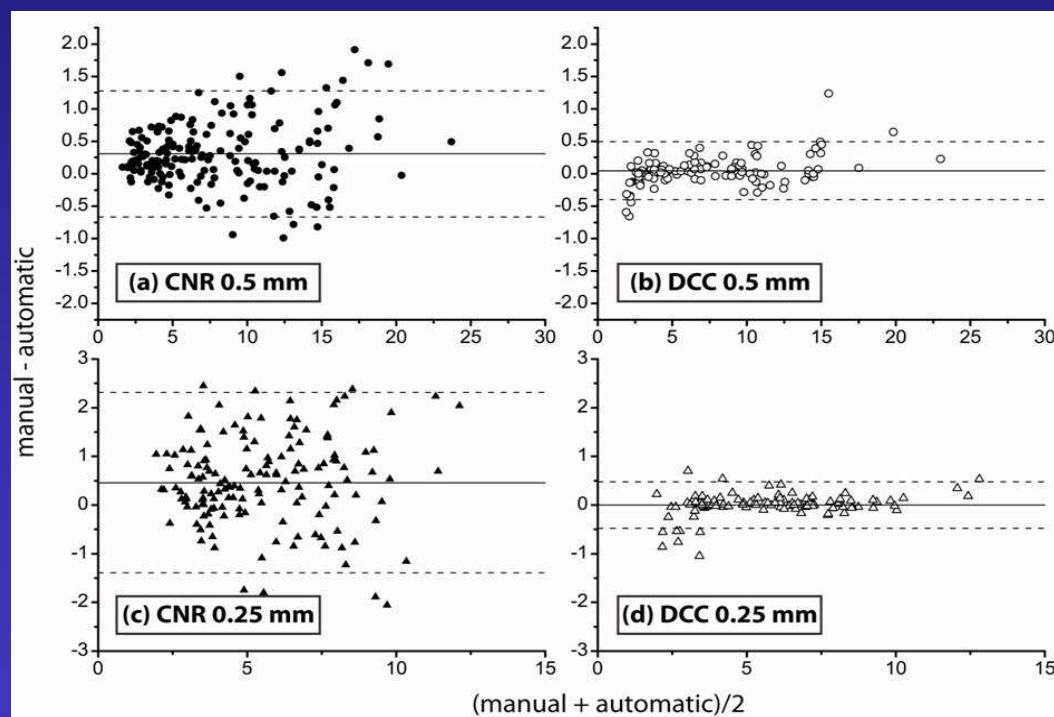
PIAAA Performs Automatic Analysis



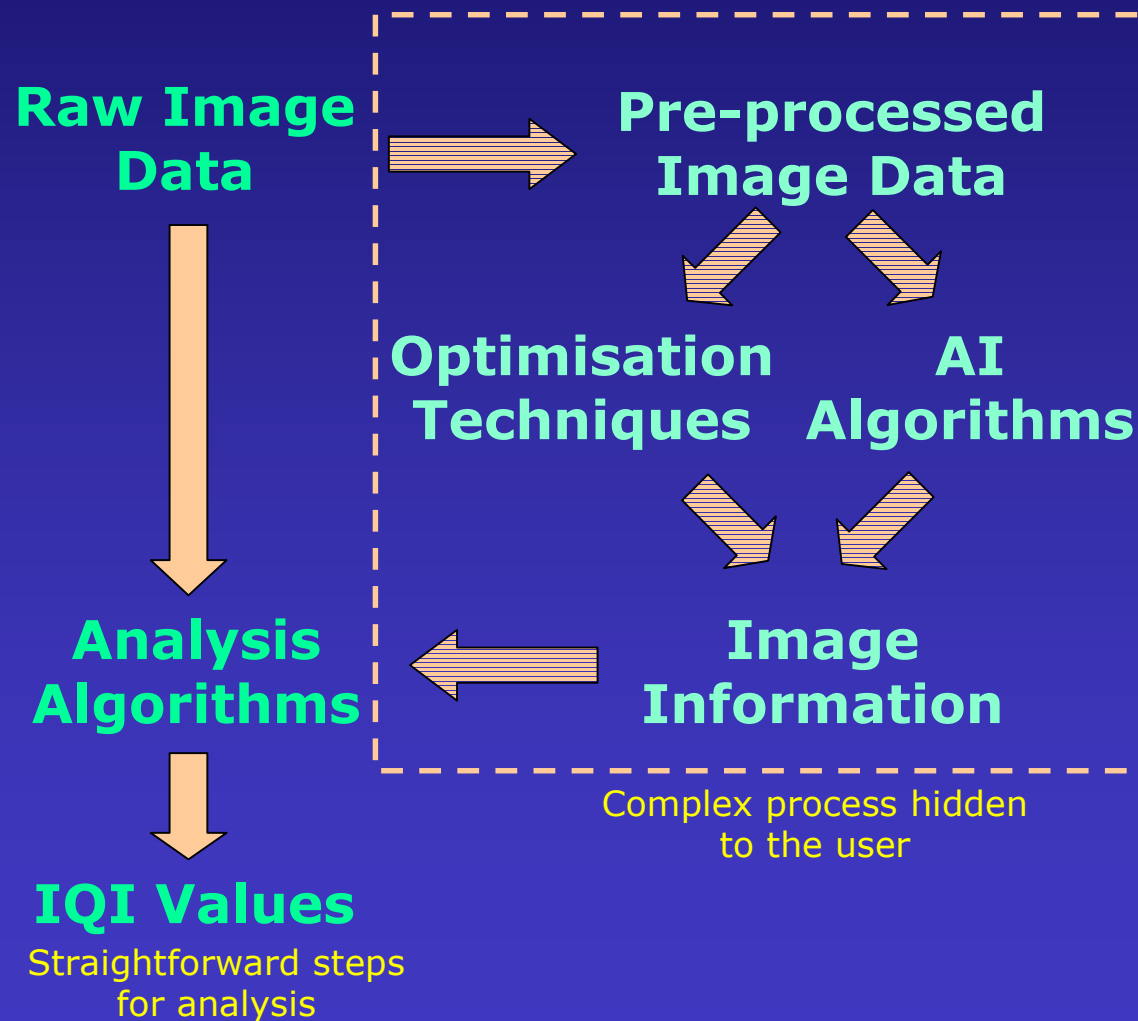
- CyberQual has developed a software called PI AAA: Phantom Image Automatic Acquisition and Analysis
- PI AAA delivers all benefits of automatic analysis, but also offers
 - Unquestionable results
 - Easy to use environment
 - Means to perform custom analysis and reporting
 - Solid software foundation with great support

Unquestionable Results

- Nobody can argue against PIAAA IQI values, because
 - Metrics have a scientific base
 - They have been validated
 - Measurements are objective
- A scientific-based validation has been performed by an independent research centre

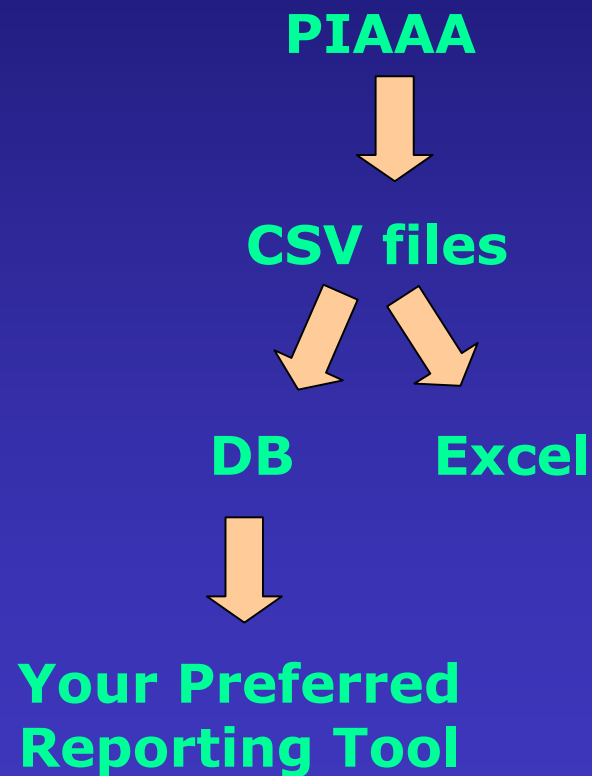


Easy to use Environment



- Computing IQI is difficult, because images greatly differ by many aspect
 - Orientation
 - Magnification
 - Contrast and noise
 - Pixel depth
- PIAAA copes with these difficulties using
 - advanced AI algorithms
 - optimisation techniques
- These are hidden to final user, who just need a pair of clicks to perform the analysis

Means to Perform Custom Analysis and Reporting



- It is possible to export IQI values to Comma Separated Values (CSV) files
- CSV files are standard, and can be automatically read by
 - Spreadsheets (e.g. Excel)
 - Databases import utilities
- Spreadsheets, databases and all their companion tools
 - Allow IQI manipulation
 - With no need to learn new software

PIAAA Evaluates the same IQIs Used in Manual Analysis

- Manual analysis metrics
 - Mean Grey Level
 - Background
 - High and low density points
 - Resolution limits (line pairs per millimetre)
 - Parallel and perpendicular high contrast resolution gratings
 - Number of “visible” details
 - Large details with low contrast
 - Small details with high contrast
 - Number of step wedges “perceived” as non-uniform
 - Particle step wedges
- PIAAA integrates seamlessly in QC processes where these metrics are applied

PIAAA Uses also Other Scientifically Based Metrics

- Contrast-to-noise ratio
 - Large details with low contrast
 - Small details with high contrast
- Detail Compact Contrast
 - Small details with high contrast
- Relative contrast
 - Uniform step wedges
- Modulation of the low frequency bars
 - High contrast resolution gratings
- Ratio between variances of micro particle step wedges and uniform step wedge (structural noise vs. quantum noise)
 - Micro particle step wedges

Want to Spare Money while Delivering Better Results?

- Human observation QC is
 - Costly
 - Unreliable
 - Questionable
- On the contrary, automatic analysis is
 - Cheap
 - Objective
 - Efficacious
 - Reproducible
- PIAAA implements automatic analysis, and also offers
 - Scientifically-based IQIs
 - Advanced algorithms
 - Solid software foundation
- Therefore, PIAAA analysis results are
 - Unquestionable
 - Easy to perform
 - Supported by CyberQual



A New Version Approaching



- In the continuous improvement spirit, CyberQual will deliver a new major release by the end of the year
- Main new features
 - Automatic phantom recognition
 - Multiple file management
 - Logbook
 - Warning for critical IQI values
 - Reporting
 - Improved user interaction
 - Modern looking
 - Linux/Mac compatibility
 - Network licensing

Thank you

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