XA_CHO Manual

Introduction

XA_CHO is a Graphical User Interface (GUI) designed to streamline the process of generating contrast-detail curves for medical imaging systems. This program assists users throughout the process, from loading images to obtaining final contrast-detail curves.

Getting Started

To begin using XA_CHO, follow these steps:

- Launch the XA_CHO program.
- Load a DICOM multi-frame sequence of the phantom acquired with the desired protocol.

Features

GUI Overview

The GUI of XA_CHO consists of three main phases:

Phase 1: Load Images or Workspace. This phase allows users to load DICOM multi-frame sequences or workspaces.

Phase 2: CHO Contrast-Detail Curve Calculation. Users can perform contrast-detail curve calculations in this phase.

Phase 3: 2-AFC Human Test. This phase facilitates 2-AFC (Two-Alternative Forced Choice) human testing.

Registration Process

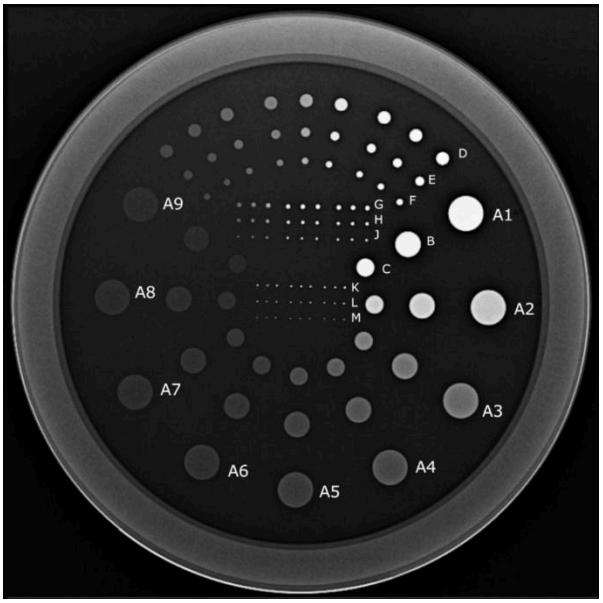


Figure 1 Leeds TO10 phantom with targets labeled as used in this program.

After loading the DICOM sequence, users can register the phantom using a 6-point affine geometrical transformation. This transformation is calculated based on the indicated six points of the phantom: K1, L1, G1, H1, J1, D1, and D4 targets. These points represent different diameters and contrasts of the phantom targets.

Manual Indication of Points

Users manually indicate the points on the averaged sequence.

The data from these points are used to calculate the geometrical transformation using a previously calculated parametrical description of the TO10 phantom.

AFC Human Test

After the registration process, users can perform a 2-AFC (Two-Alternative Forced Choice) human test. In this test, human observers are presented with pairs of images and must indicate whether the signal target is in the left or right image.

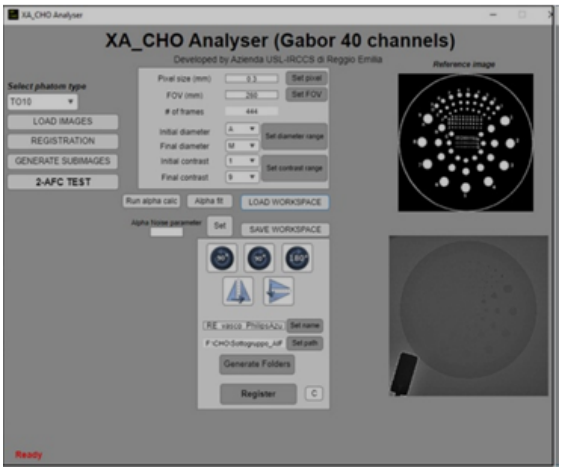
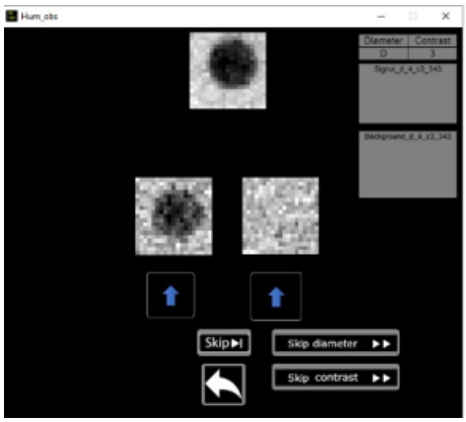


Figure 2 XA_CHO Analyser GUI.

Procedure:

1. Presentation of Image Pairs: Pairs of images are presented to human observers.
2. Observer Response: Observers indicate whether the signal target is in the left or right image.
3. Data Collection: The responses from human observers are collected for further analysis.



Tuning Alpha and Computing CD Curves

Following the 2-AFC test, the alpha value is tuned and set based on the collected observer data. Once the alpha value is set, users can compute a Contrast-Detail (CD) curve using the CHO (Channelized Hotelling Observer) model AUCs (Area Under the Curve).

Procedure:

1. Alpha Tuning: Based on the collected human observer data, the alpha value is adjusted to optimize the performance of the CHO model.
2. Setting Alpha: Once the optimal alpha value is determined, it is set for further calculations.
3. CD Curve Computation: Using the set alpha value, users can compute the CD curve utilizing the AUCs generated by the CHO model.
4. Storage: The computed CD curves can be stored for future reference or analysis.

Conclusion

By incorporating the 2-AFC human test and utilizing the CHO model AUCs for CD curve computation, XA_CHO provides users with a comprehensive tool for evaluating the performance of medical imaging systems. This integrated approach enhances accuracy and reliability in assessing contrast-detail relationships.