

# Artificial Intelligence: AI and the Art of Sonography



Jean Lea Spitz, MPH, CAE, RDMS  
Executive Director, Perinatal Quality Foundation  
Professor Emeritus, University of Oklahoma

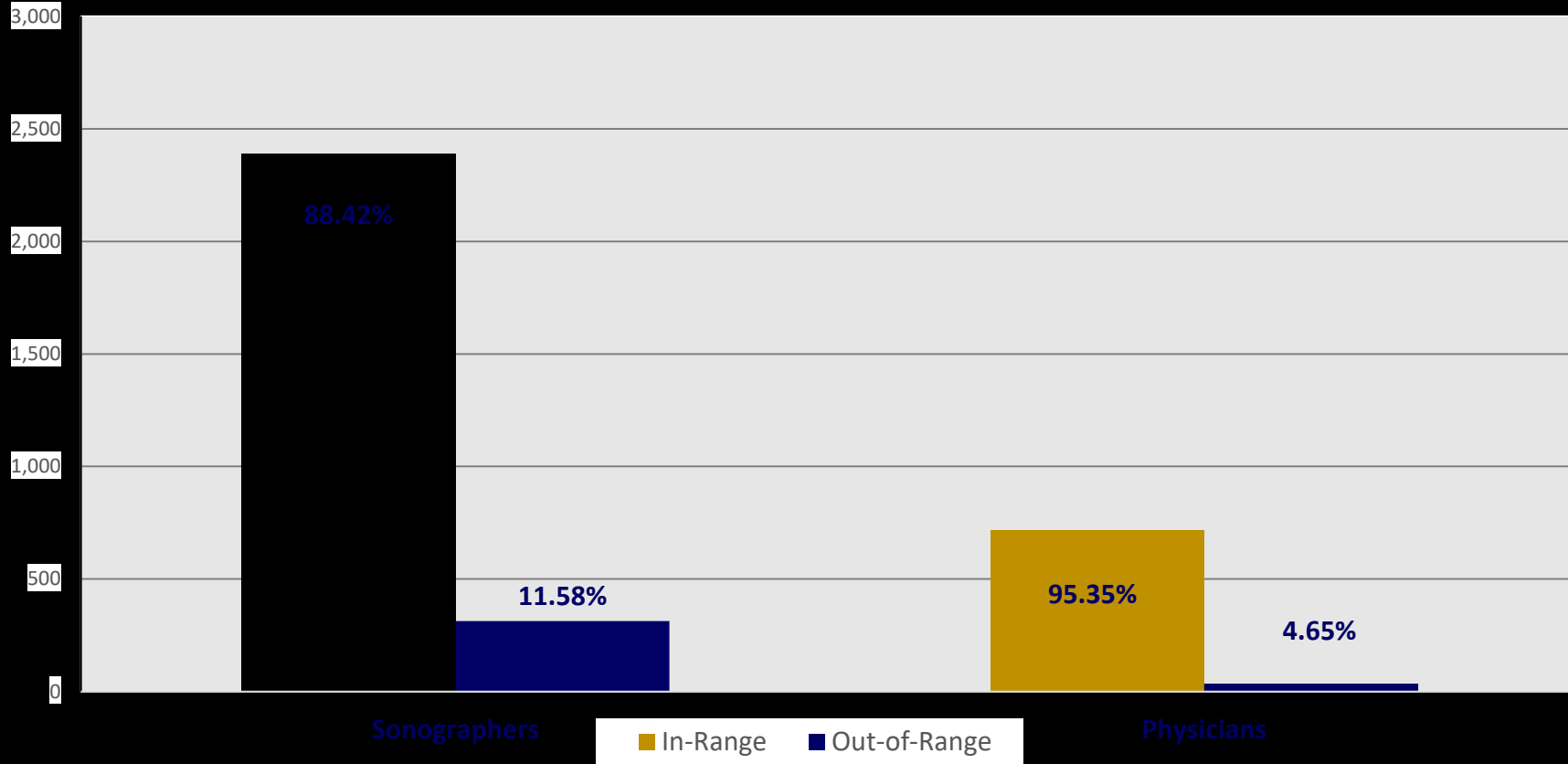
Sonography = The Art of Drawing with Sound

# The Perinatal Quality Foundation Experience



- Nuchal Translucency Quality Review Credentialing Program
- Requires education, test, and image review
- Applies standardized measurement criteria
- Reviewers scored 5,359 images last year, and >59,700 since 2009
  - 2009 – 2020 : 72% of images meeting 7/9 criteria required to pass
  - 2019 - 2020 : 60% of images meeting 7/9 criteria required to pass
- Credentialed participants' measurements are received from laboratories and monitored by comparison to referenced curves
- Successful in bringing participants closer to center

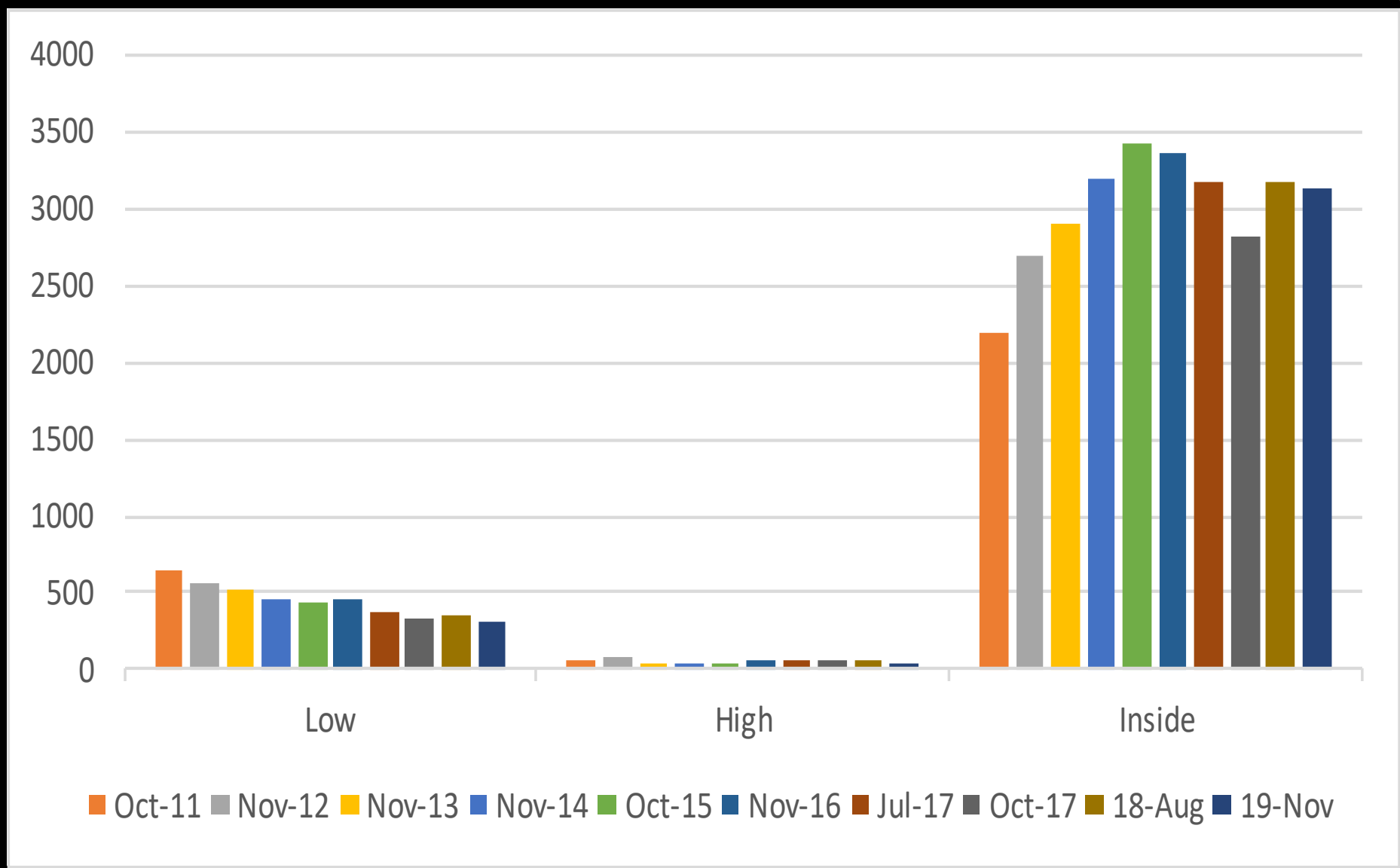
# Providers > 30 data points November 2019



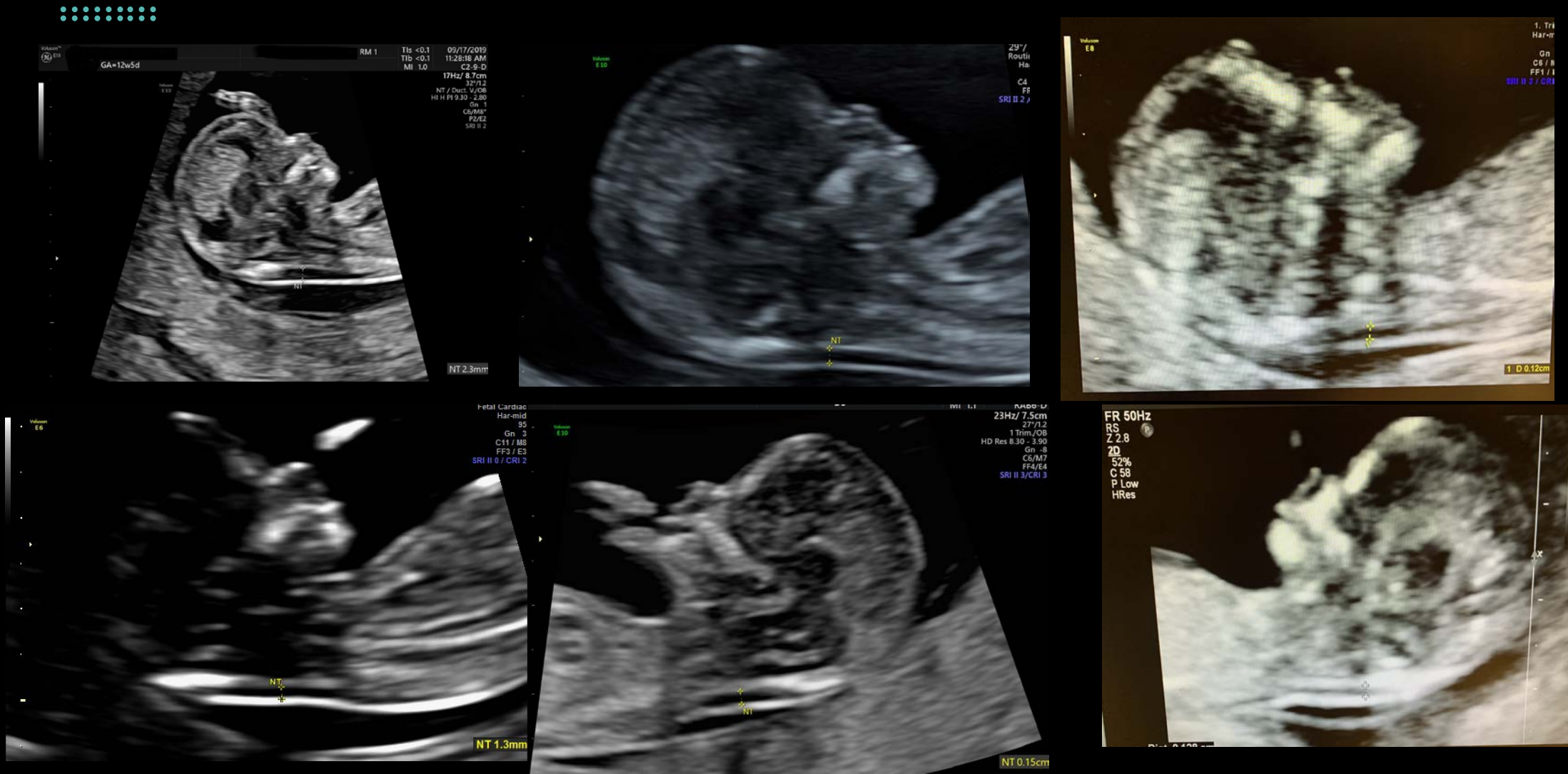
Sonographers (n= 2703) 88.4% are within range

Sonologists (n=753) 95.3% are within range

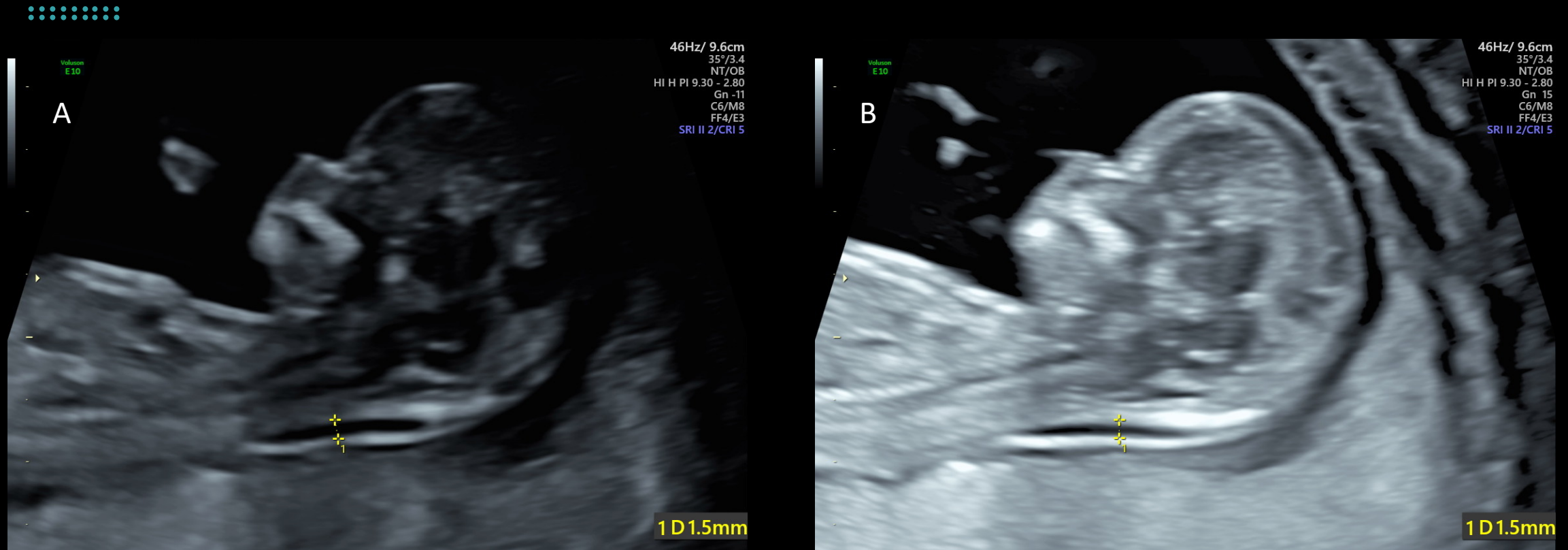
# Program Impact



# Problem: Variety of Images



# Problem: Inaccurate Measurements



Criteria requires placement of caliper on external edge of the boundary line which would under-measure Image B

# Problem: Inaccurate Measurements



Criteria requires placement of caliper on external edge of the boundary line which would under-measure Image B



# Problem: Inaccurate Measurements



Automated NT measurement does not adjust for reverberations or high gain leading to under-measurement

Conclusion: AI needs to help  
with acquisition of input images,  
not just analysis

# Sonography: The Acquisition of an Image

## CLASSIFICATION



Scanning a wide area

Selecting images with the region of interest

Requires supervision when learning

## SEGMENTATION



Selecting Pivot Point

Applying angles and pressure to optimize ROI

Assessing pathway and quality of echoes

Moving pivot point as needed

## OPTIMIZATION / DETECTION



Magnify

Adjust gain, focus, dynamic range

Fill in boundaries, reduce blurriness, speckle, thickness of lines

## APPLY DIAGNOSTIC ALGORITHM



Measure

Assess

# Classification: Selection of Image Area



Wide area “scanning”

Learning to select requires supervision

Apply color to help pinpoint ROI in some situations

# Segmentation:



- Select Pivot Point
- Angle to select pathway
- Apply pressure to bring out boundaries and detail
- Compensate for Adiposity
- Assess quality of echoes throughout region of interest (ROI)
- Move pivot point or angle as needed --- Location variable and determined by optimal appearance of ROI
- Determine acceptability of image for specific algorithm

# Optimization / Detection



- Magnify ROI
- Fill-in boundaries
- Decrease thickness of lines and blurring of lines
- Optimize dynamic range of echo strength
- Optimize gain / strength of echoes
- Apply and optimize color if needed for diagnosis
  
- Apply measurement criteria or diagnostic algorithm

# Sonography: The Acquisition of an Image

## CLASSIFICATION



Scanning a wide area

Selecting images with the region of interest

Requires supervision when learning

## SEGMENTATION



Selecting Pivot Point

Applying angles and pressure to optimize ROI

Assessing pathway and quality of echoes

Moving pivot point as needed

## OPTIMIZATION / DETECTION



Magnify

Adjust gain, focus, dynamic range

Fill in boundaries, reduce blurriness, speckle, thickness of lines

## APPLY DIAGNOSTIC ALGORITHM



Measure

Assess

# Conclusions



- AI is needed in sonography
- Not just for analysis of images but for optimal acquisition
- Acquisition requires assessment of image quality throughout
- Mimicking sonography imaging methods may provide a roadmap for AI acquisition