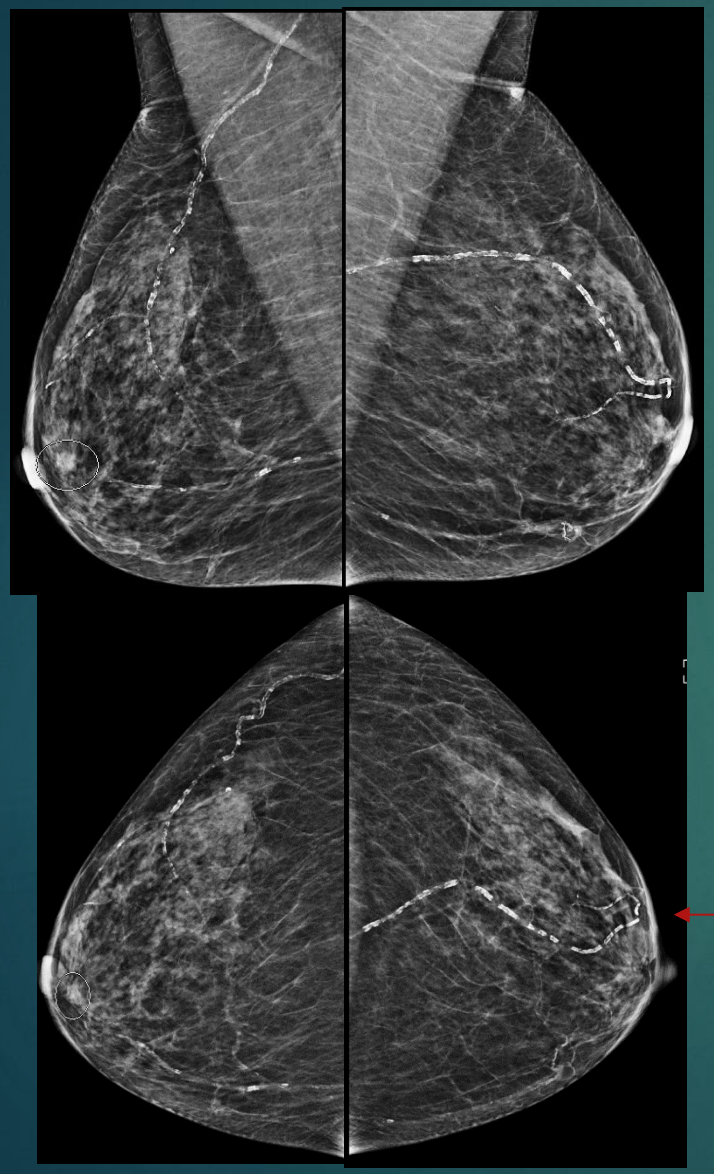
BAC Scoring and Annotations Examples

BAC Scoring by the Radiologist

- **Laterality**
  - 1= Unilateral Breast
  - 2 = Bilateral Breast
- **Number of Vessels***
  - # of vessels are each coded numerically from 1-6.
    - 1 = 1 vessel
    - 2 = 2 vessels
    - 3 = 3 vessels
    - 4 = 4 vessels
    - 5 = 5 vessels
    - 6 = 6 or more vessels
  - If greater than six vessels, then please use the number six.
- **Length of vessel***
  - 0 = none
  - 1 = Less than 1/3 of vessel
  - 2 = Between 1/3 and 2/3 of vessel
  - 3 = Greater than 2/3 of vessel
- **Lumen Density/Transparency***
  - 0 = None
  - 1 = Mild, clear lumen
  - 2 = Moderate, cloudy lumen
  - 3 = Severe, No Lumen seen
- **BAC Vessel Continuity**
  - 1 = Discontinuous
  - 2 = Continuous
- **Vessel Wall Involvement**
  - 1 = One wall
  - 2 = Both walls
- **Vessel Caliber (Diameter)**
  - Small (Min. Diameter)
  - Large (Max. Diameter)
  - Combination both large and small (max. and min. diameters)

* Margolies et al., 2016 & Yoon et al., 2019

Laterality



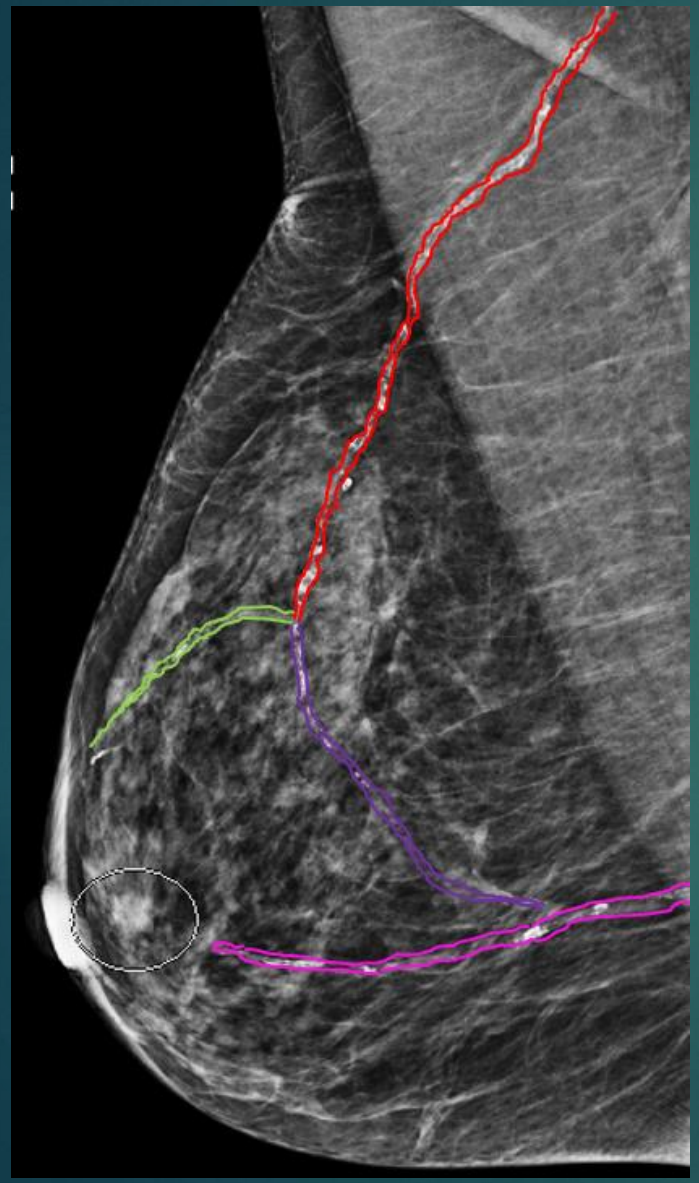
This patient would get a score of 2. Calcifications are in both breasts.

Classification for Model

- 1= Unilateral Breast
  - Either right or left (MLO or CC)
- 2 = Bilateral Breast
  - Present on at least 2 images (one in each breast)

- Questions: Can the AI tell right from left? (i.e. if we annotate BAC in the right and left breast, can the AIM infer that BAC is bilateral?)

Number of Vessels



Right MLO: Demonstrates branching Vessels Highlighted. Each color represents a different vessel. Based only on the colored vessels, the score would be 4.

Classification for Model:

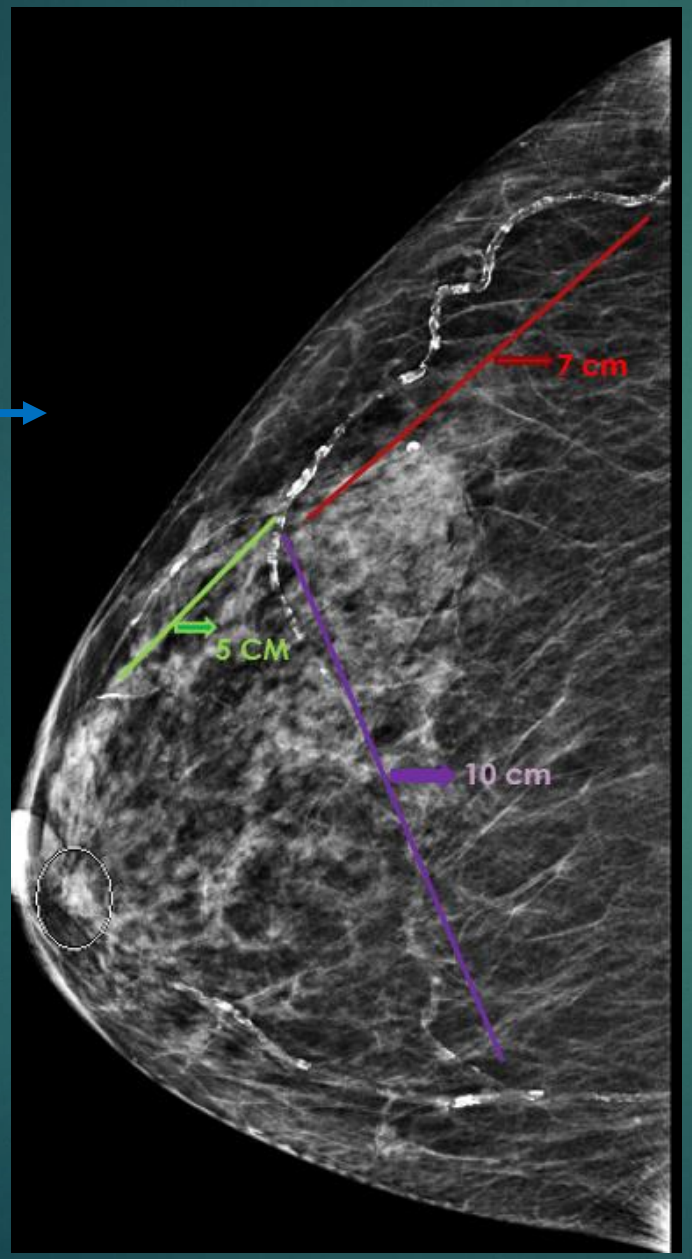
- Each vessel is color coded
  - If the same vessel is seen on MLO and CC, please code the vessel the same color.
- Branch points are considered new vessels.

Questions: Can the AI count the individual vessels and how do we accomplish this? Is there a limit to the number of colors for coding?

Length of Vessel

Example of vessels and rough measurements

Each vessel will be measured individually

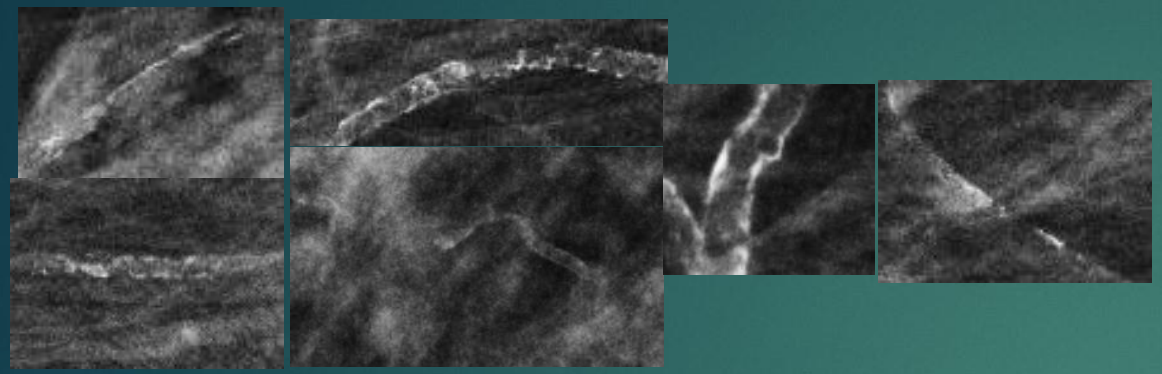


Classification for Model

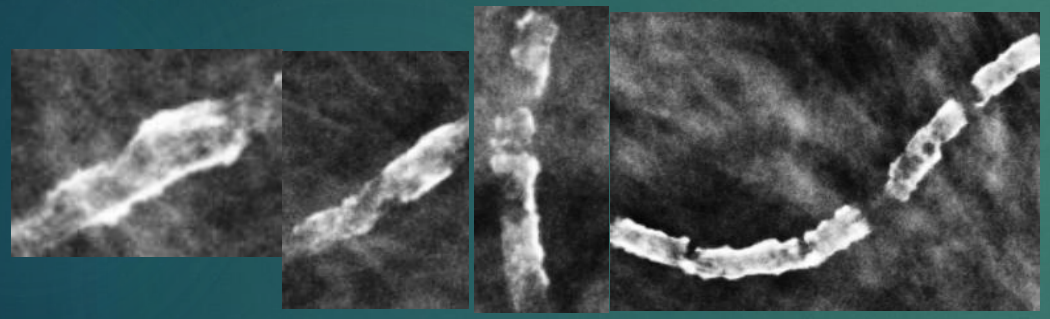
- Questions: If we trace out the vessel and annotate the BAC, can the AIM calculate the length of the vessel involved by BAC? If not, how can we train the AI to quantify vessel lengths? Can it do better than the radiologist scoring the vessel length in thirds?

Lumen Density/Transparency

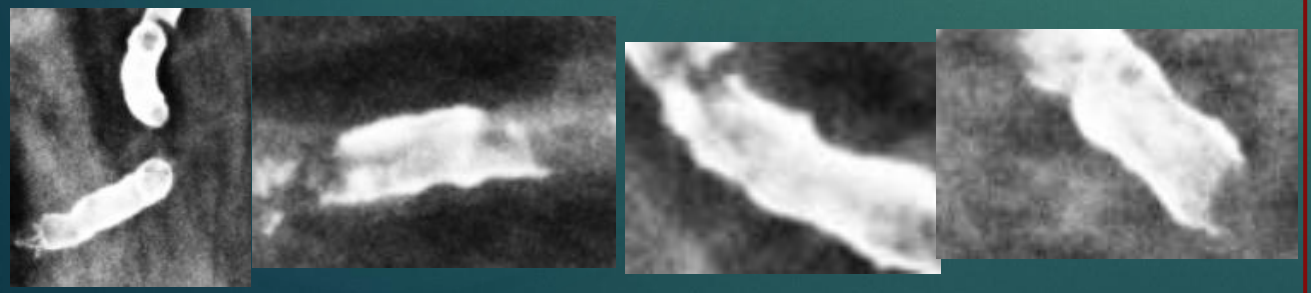
Examples of Mild: Clear Lumen



Examples of Moderate: Cloudy Lumen



Examples of Severe: No Lumen Seen



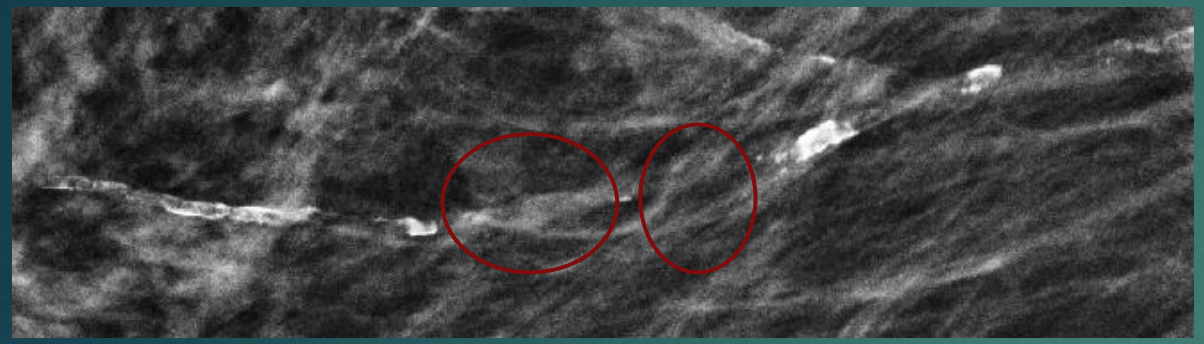
Classification for model

- 0= None
- 1= Mild, clear lumen
- 2= Moderate, cloudy lumen
- 3= Severe, No Lumen seen

- Question: How can we annotate for lumen density? Do we code with different colors? Do we text label?

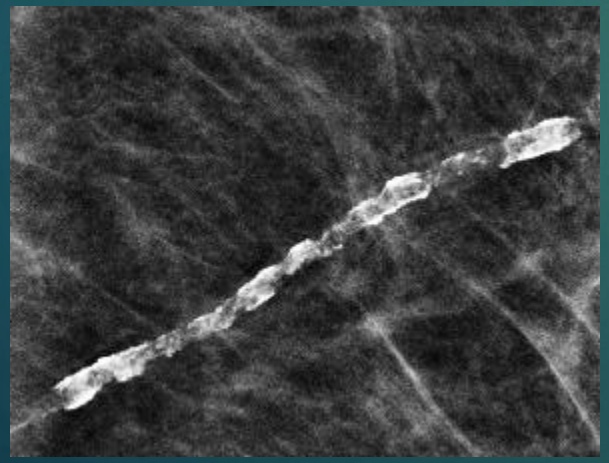
BAC Vessel Continuity

Examples of Discontinuous Vessel



There are no calcifications in the vessels in the areas circled in red.

Example of Continuous Vessel



There are no breaks in the calcifications in the vessel walls.

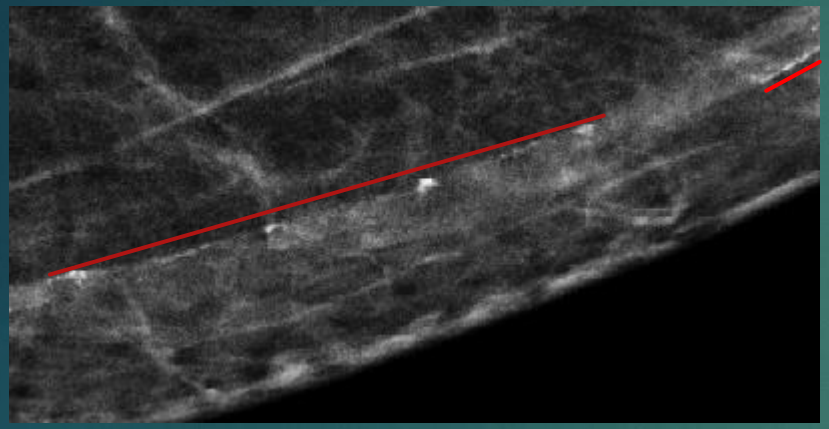
Classification for Model

- 1 = Discontinuous
- 2 = Continuous
- Continuous BAC can involve one wall or both walls. Same score.
- To be classified as discontinuous, both vessel walls must not have calcification.

Questions: Should we label the naked/noncalcified vessel if it is visible? How do you propose labeling?

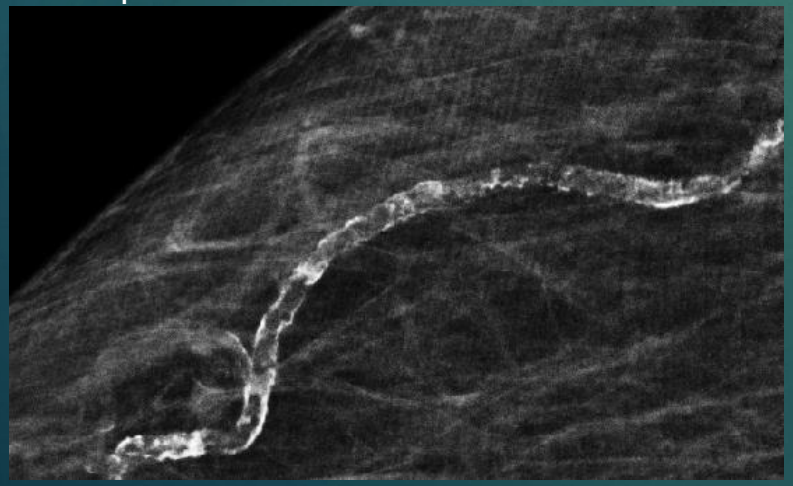
Vessel Wall Involvement

Examples of Single Vessel Wall BAC



There are calcifications one vessel wall as shown by red lines.

Examples of Both Vessel Wall BAC



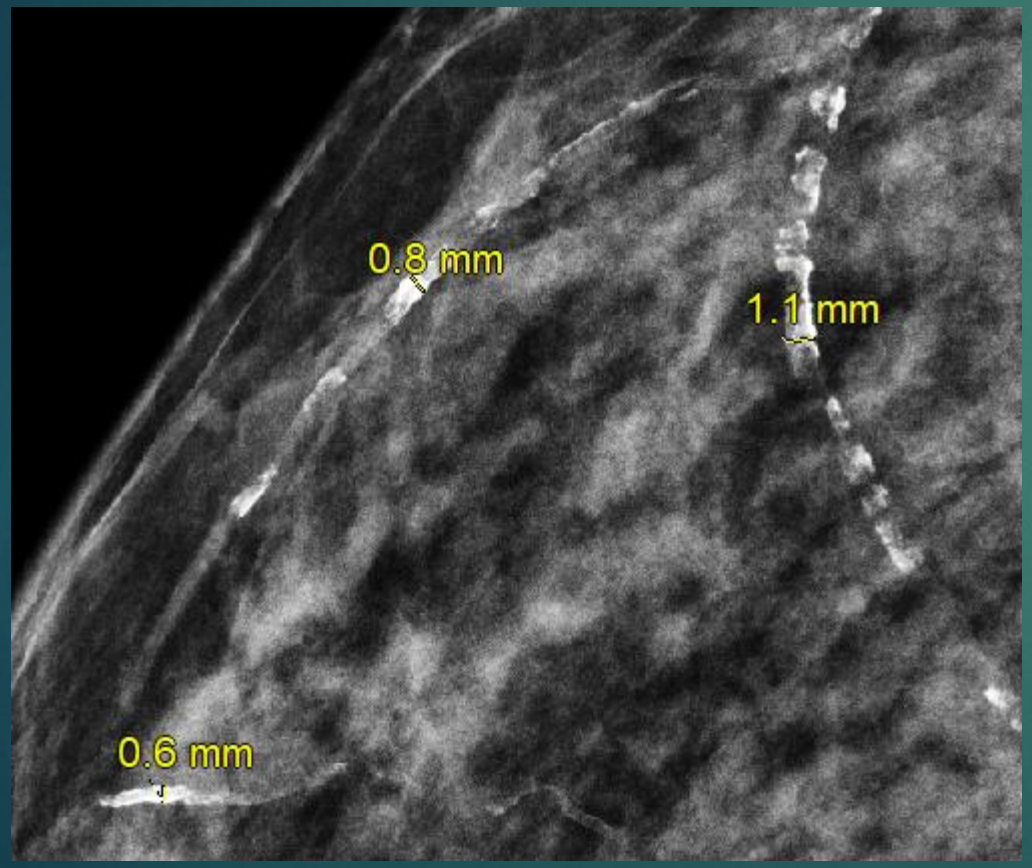
Classification for Model

- 1 = One wall
- 2 = Both walls

- Questions: How do you propose labeling?

Vessel Caliber (Diameter)

Sample of Vessel Diameter



Classification for Model

- Small (Min. Diameter)
- Large (Max. Diameter)
- Combination both large and small (max. and min. diameter)

- Questions: Does this need to be annotated or, if we trace the vessel, can its caliber be calculated? If it needs to be annotated, how should we annotate a measurement? How will the measurement associate with the label?