Breast cancer is predicted to affect approximately 300,000 new patients in 2013 in the US alone. Breast cancer tumor can be characterized as benign (non-life threatening) or malignant (cancerous). The shape (boundary) of the tumor can help distinguish between benign and malignant tumors (ref. 36) which is important in screening. Studies have shown malignant tumors have rough edges (compare (a) and (b) in Fig. S1). Thus, accurate identification of the shape, especially the edges of the tumor is important for a reliable tactile imaging method for screening.

Figure S1. Cross – sectional mammograms of benign (a) and malignant (b) tumors in breast cancer. Image size is 31.5 x 36.5 mm in (a), and 37.2 x 47.7 mm in (b). (Adapted from Ref. 36)
In order to quantify touch/palpation, four Silicone rubbers were employed to prepare palpable structures (Fig. 3, 4, and 5). Their mechanical properties of the three samples under compressive load are shown in Fig. S2. The stress, $\sigma$ is measured as a function of applied strain, $\varepsilon$. The elastic modulus of each sample is calculated from the slope of the stress-strain curve.

Figure S2. Stress–strain measurements of silicone materials used to construct palpable structures.
For demonstration of the thin film tactile device in quantifying physical breast examination similar to Clinical Breast Examination, a translucent breast model from MammaCare Corp. was tested. The mechanical properties of the breast model are realistic in terms of overall stiffness and are used to train medical personnel for CBE. There are 5 fillers of different shapes and size, located at depths ranging from ~ 2 to 20 mm (Fig. 6b). The tactile image of each of the fillers (i.e., simulated mass) 20 mm below the surface were correctly detected in the tactile images, including the anisotropic shape (Fig. 6). During the palpation experiment, small distortion occurs because the filler is mobile. Figs. S3 and S3 show a series of imaged by simply wiggling the device relative to the model while maintaining complete contact.

Figure S3. (a) to (d) A series of tactile images of the “red” filler (5 mm) in the breast model revealing its identity.
Figure S4. (a) to (d) A series of tactile images of the “pink” filler in the breast model. Similar to Fig. S3, the filler moves during imaging.