### Supplementary Table 1

|                        | Early Stage |          | Late Stage |          |
|------------------------|-------------|----------|------------|----------|
|                        | n           | %        | n          | %        |
| **Sex**                |             |          |            |          |
| Female                 | 74          | 100      | 26         | 100      |
| Male                   | 0           | 0        | 0          | 0        |
| N/A                    | 0           | 0        | 0          | 0        |
| **Stage**              |             |          |            |          |
| Early                  | 74          | 100      | 0          | 0        |
| Late                   | 0           | 0        | 26         | 100      |
| N/A                    | 0           | 0        | 0          | 0        |
| **ER Status**          |             |          |            |          |
| Positive               | 47          | 64       | 9          | 35       |
| Negative               | 6           | 8        | 6          | 23       |
| N/A                    | 21          | 28       | 11         | 42       |
| **PR Status**          |             |          |            |          |
| Positive               | 43          | 58       | 6          | 23       |
| Negative               | 11          | 15       | 9          | 35       |
| N/A                    | 20          | 27       | 11         | 42       |
| **HER2 Status**        |             |          |            |          |
| Positive               | 7           | 9.5      | 4          | 15       |
| Negative               | 40          | 54       | 10         | 39       |
| N/A                    | 27          | 36.5     | 12         | 46       |
| **Histological Subtypes** |         |          |            |          |
| Ductal                 | 48          | 58       | 11         | 23       |
| Lobular                | 5           | 15       | 3          | 35       |
| Other                  | 1           | 27       | 0          | 42       |
| N/A                    | 20          | 27       | 12         | 42       |
| **Tumor Grade**        |             |          |            |          |
| 1                      | 24          | 32.5     | 1          | 4        |
| 2                      | 21          | 28.5     | 6          | 23       |
| 3                      | 9           | 12       | 5          | 19       |
| N/A                    | 20          | 27       | 14         | 54       |

N/A: data not provided.
Supplementary Figure 1

Supplementary Figure 1. Visualization of rare cell features. T-SNE embedding of rare cells based on morphometric features derived from OCULAR. Each designated color represents a classification group marked in the figure.