$$f\left(x^{(i)}|\theta\right) = \theta^{x^{(i)}}(1-\theta)^{1-x^{(i)}}$$

$$L(\theta)$$

$$= \prod_{i=1}^{m} f\left(x^{(i)}|\theta\right)$$

$$= \theta^{x^{(1)}}(1-\theta)^{1-x^{(1)}} * \theta^{x^{(2)}}(1-\theta)^{1-x^{(2)}} * \ldots * \theta^{x^{(m)}}(1-\theta)^{1-x^{(m)}}$$

$$= \theta^{\sum_{i=1}^{m} x^{(i)}}(1-\theta)^{m-\sum_{i=1}^{m} x^{(i)}}$$

$$LL(\theta) = \log L(\theta) = \left(\sum_{i=1}^{m} x^{(i)}\right)\log\theta + \left(m - \sum_{i=1}^{m} x^{(i)}\right)\log(1-\theta)$$

$$\theta_{MLE} = argmax_{\theta} \log L(\theta)$$

$$\frac{\partial LL(\theta)}{\partial\theta} = \frac{\partial\left(\sum_{i=1}^{m} x^{(i)} \log\theta + \left(m - \sum_{i=1}^{m} x^{(i)}\right)\log(1-\theta)\right)}{\partial\theta} = \frac{\sum_{i=1}^{m} x^{(i)}}{\theta} - \frac{m - \sum_{i=1}^{m} x^{(i)}}{1-\theta} = 0$$

$$(1-\theta)\sum_{i=1}^{m} x^{(i)} - \theta\left(m - \sum_{i=1}^{m} x^{(i)}\right) = 0$$

$$\sum_{i=1}^{m} x^{(i)} - \theta\sum_{i=1}^{m} x^{(i)} - m\theta + \theta\sum_{i=1}^{m} x^{(i)} = 0$$

$$\theta_{MLE} = \frac{\sum_{i=1}^{m} x^{(i)}}{m}$$