

**Biometric Authentication on Mobile Devices –  
Homework 5  
Released 10/16/19  
Due 10/30/19**

1. What is the purpose of the papillary, or friction, ridges?

The purpose of friction ridges is to help the hand grasp objects with an increased friction between the surface of the hand and the objects. Papillary ridges also aid in tactile sensation of surface textures.

2. What are latent fingerprints?

Latent fingerprints are partial fingerprints left behind.

3. Define feature-based and image-based features.

Feature-based methods extract features from an image and encode the features into a set used for matching. Image based feature methods use the image directly and do not perform feature extraction for matching.

4. Which details are observed in Level 1 features?

Level 1 features are a coarse set of features that are defined by a ridge orientation map and ridge frequency map. The ridge orientation map contains the local ridge orientation at each location of the fingerprint while the ridge frequency map records the local ridge frequency at each location of the fingerprint. In short, Level 1 detail is only defined by the ridge flow and ridge frequency.

5. What does the local ridge orientation of a pixel represent?

Local ridge orientation of a pixel at a location  $x,y$  represents the tangential direction of the ridge lines passing through  $x,y$ .

6. What are the three elements used to characterize minutiae points?

Three elements to characterize minutiae are location in the image, direction, type.

7. Why are minutiae-based systems popular?

Minutiae-based systems are popular since they are able to capture much of the discriminative information of fingerprints, are storage efficient, robust to sources different sources of degradation.

8. What are the five sensing techniques?

Optical frustrated total internal reflections (FTIR)

Capacitance

Ultrasound Reflection

Piezoelectric Effect

Temperature Differential

9. What is the Poincare index used for?

Poincare index method is used to extract fingerprint singularity from the orientation field.

10. When would a rigid transformation for aligning two fingerprints be insufficient?

Ridge transformation is insufficient if there is severe nonlinear deformation introduced during fingerprint acquisition.

11. What is the purpose of the flags in Algorithm 2?

Ensuring that only one minutiae from the template is paired with one minutiae from the query.