# Thermal images as source for biometrics

Imagens termais como fonte para biometria

“Thermal Imaging: Next Big Thing In Biometric Security”

http://www.inquisitr.com/846786/thermal-imaging-next-big-thing-in-biometric-security/

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# Tópicos

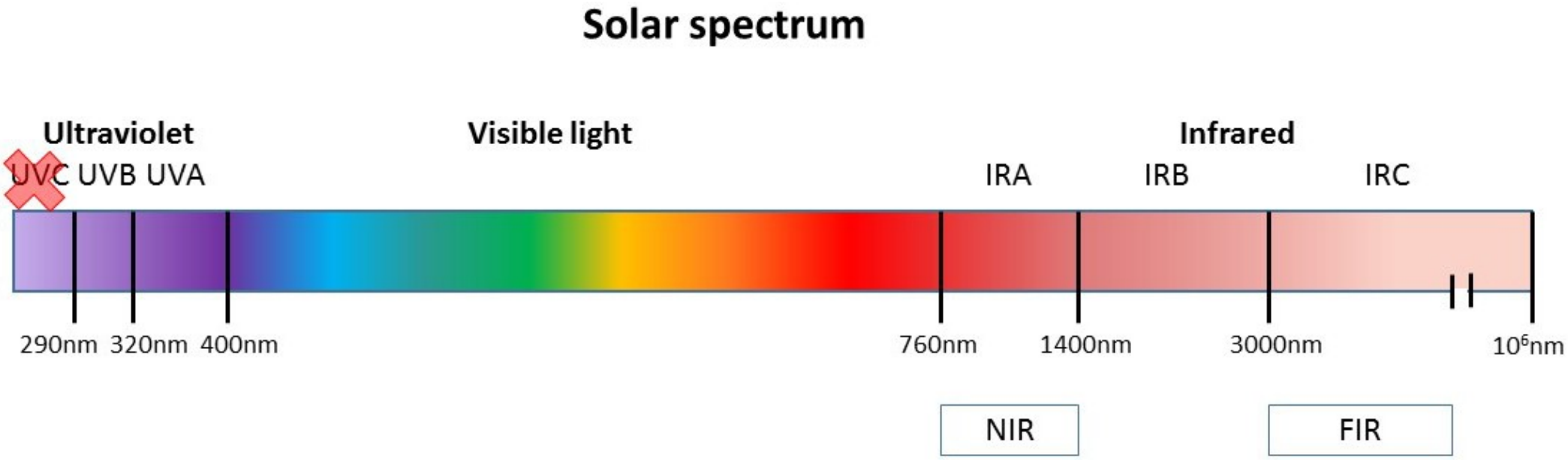
- Introdução
- Aquisição de Imagens Termais
- Região de Interesse
- Extração de Características
- Matching
- Paper – Análise de Veias em Mão

# Introdução

- Biometria
- Spoofing
- Veias / Mapas de Calor

# Aquisição de Imagens Termais

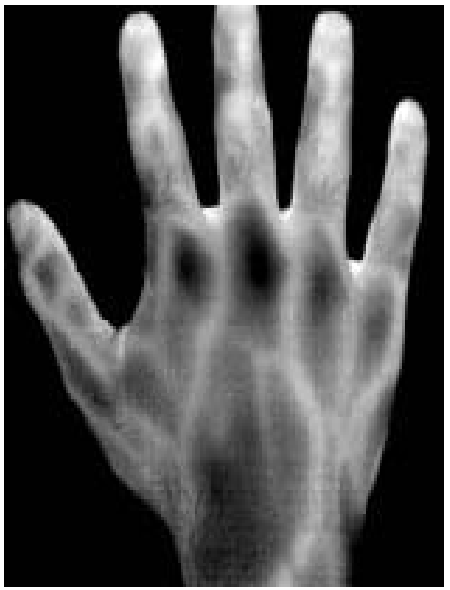
- Espectro de Luz
  - Visível
  - Infravermelho
    - FIR
    - NIR



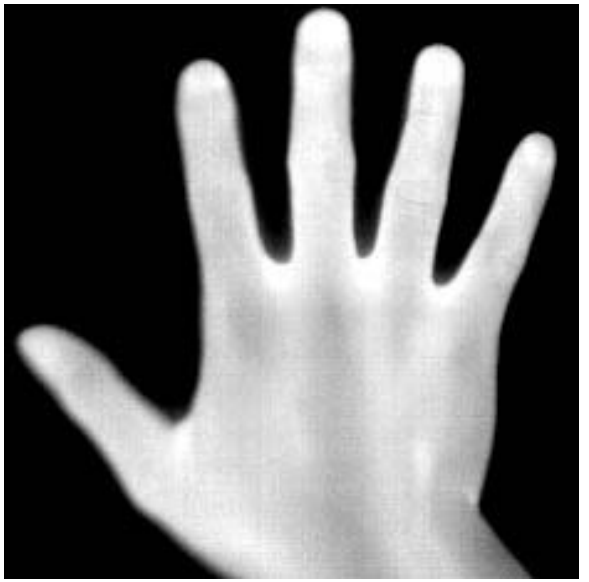
# Aquisição de Imagens Termais

- FIR (Far-infrared)
- Ambiente
  - Temperatura
  - Umidade

Interno

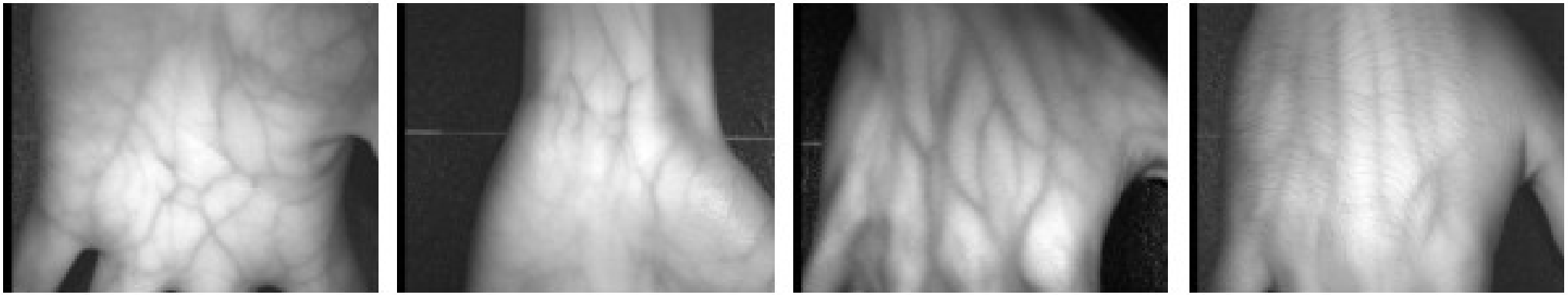


Externo



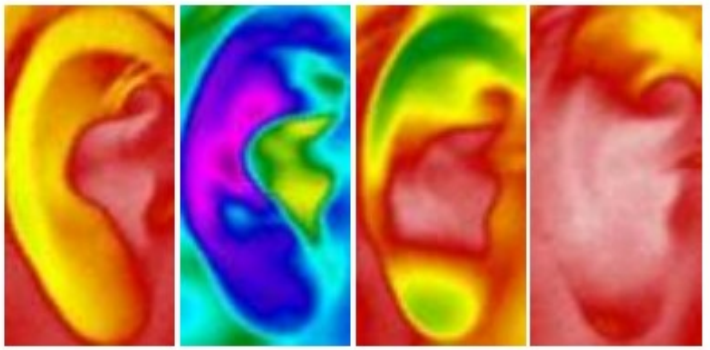
# Aquisição de Imagens Termais

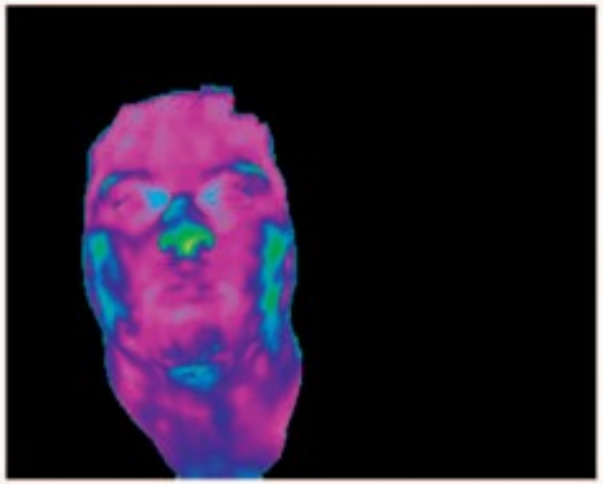
- NIR (Near-infrared)
- Detalhes
  - Pelos
  - Defeitos na pele
  - Palm print

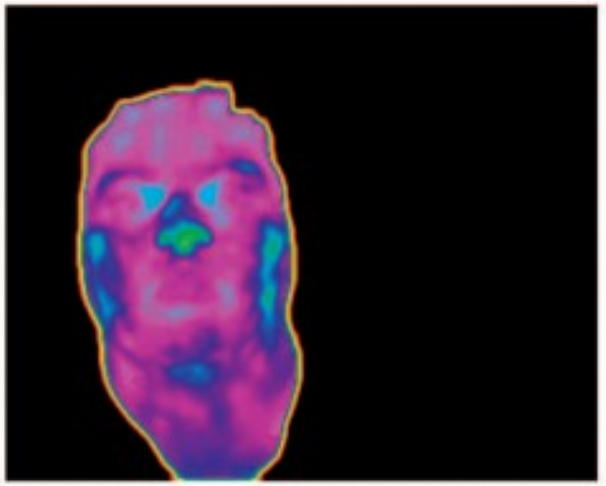


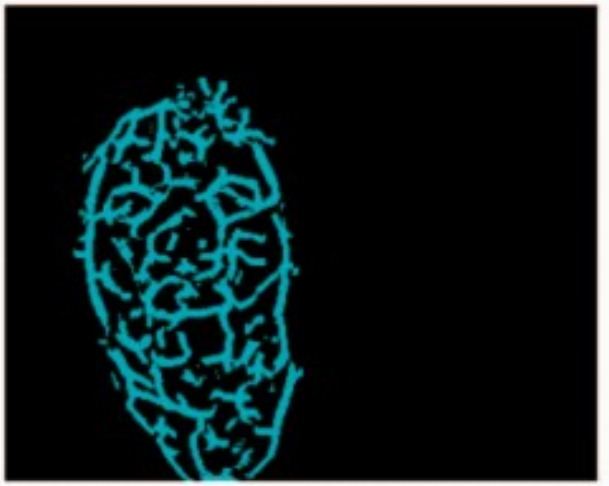
# Região de Interesse

- Regiões de Extração
  - Mão (palma / dorso)
  - Punho
  - Face
  - Orelha



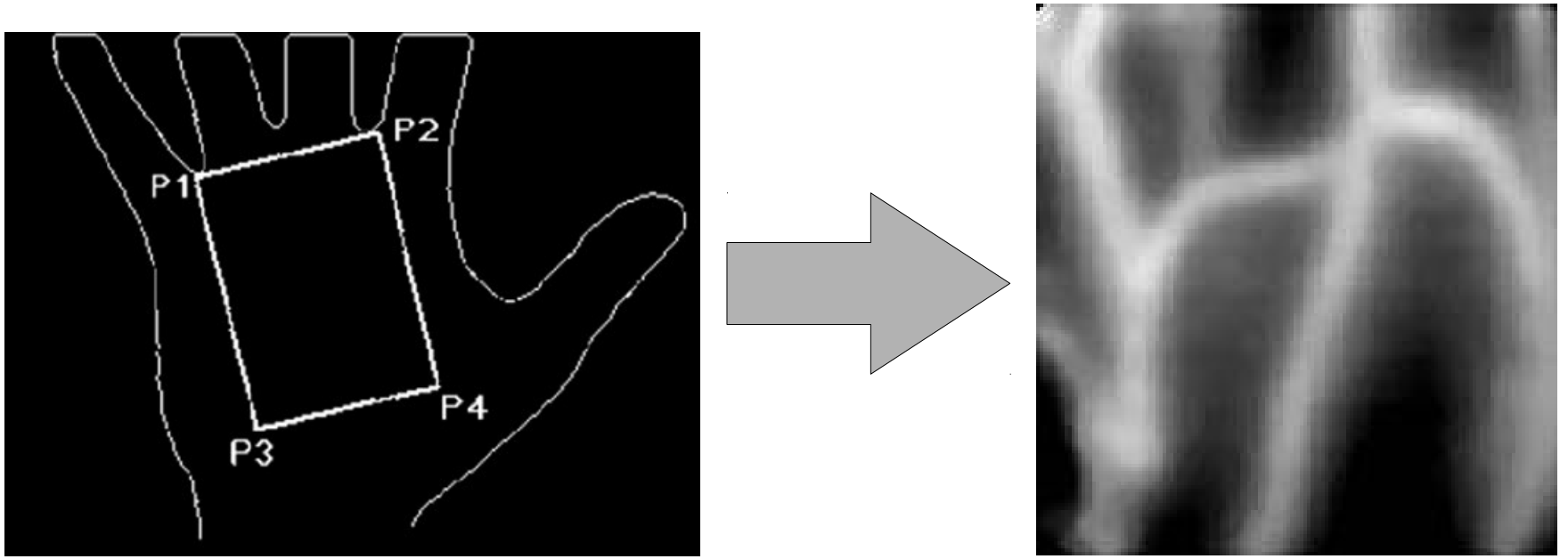






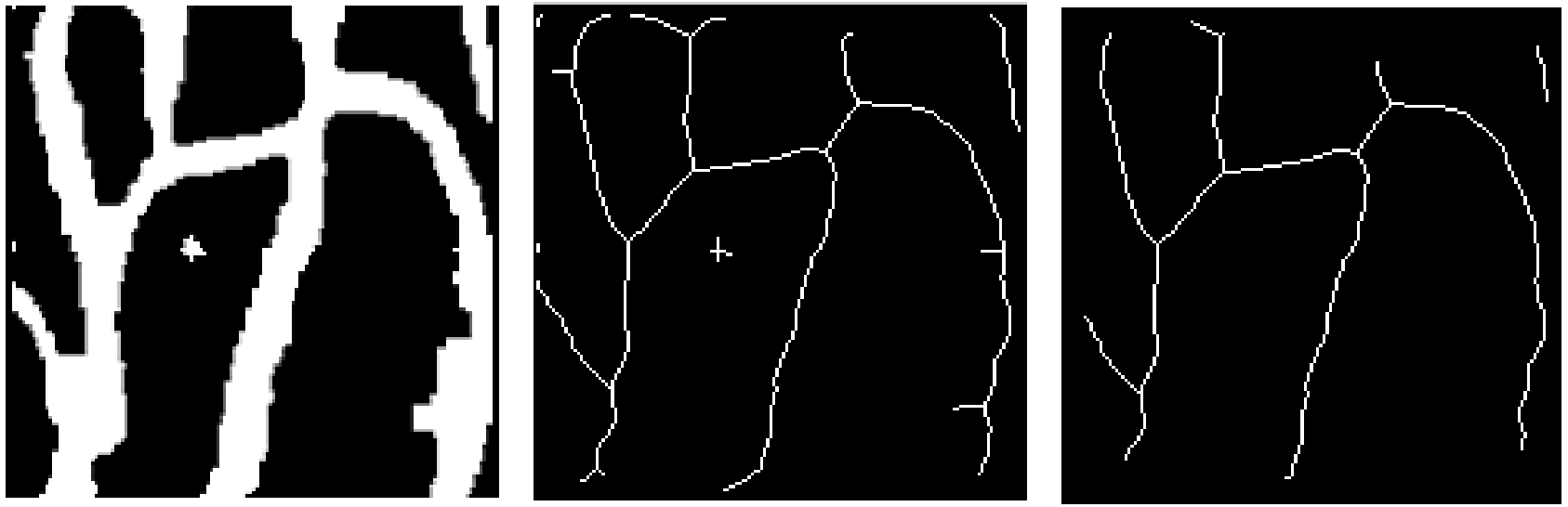
# Região de Interesse

- ROI (Region of Interest)
  - Segmentação
  - Rotação



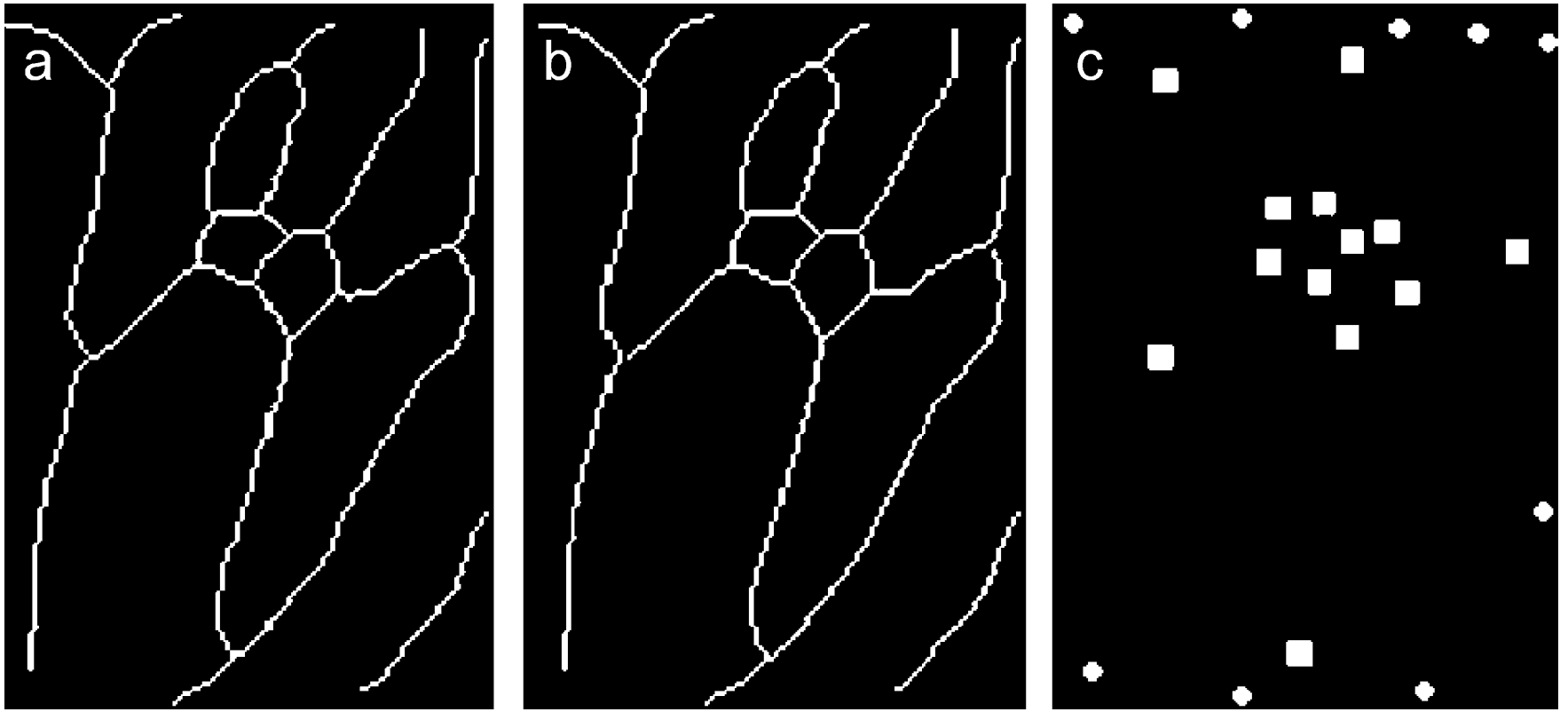
# Extração de Características

- FPVP (Feature Points of Vein Pattern)
  - Binarize
  - Skeletonize
  - Redução de Ruídos
    - Prunning



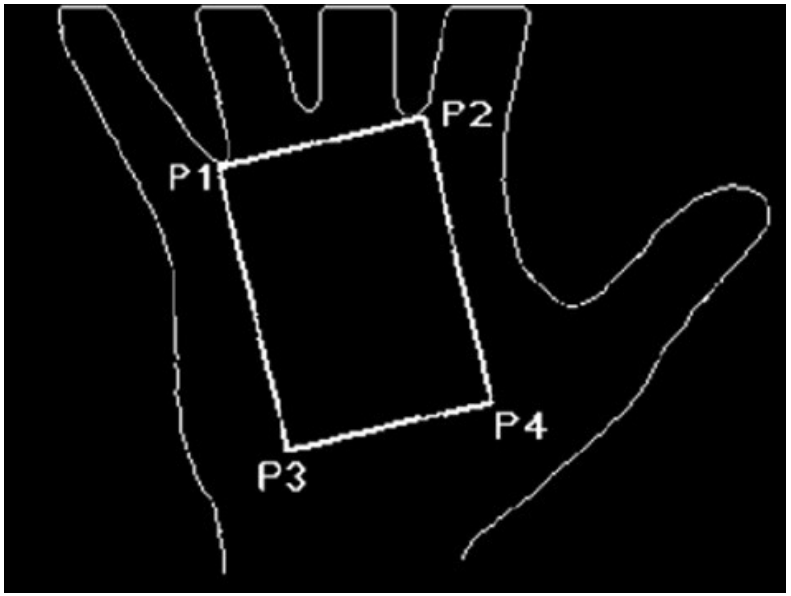
# Extração de Características

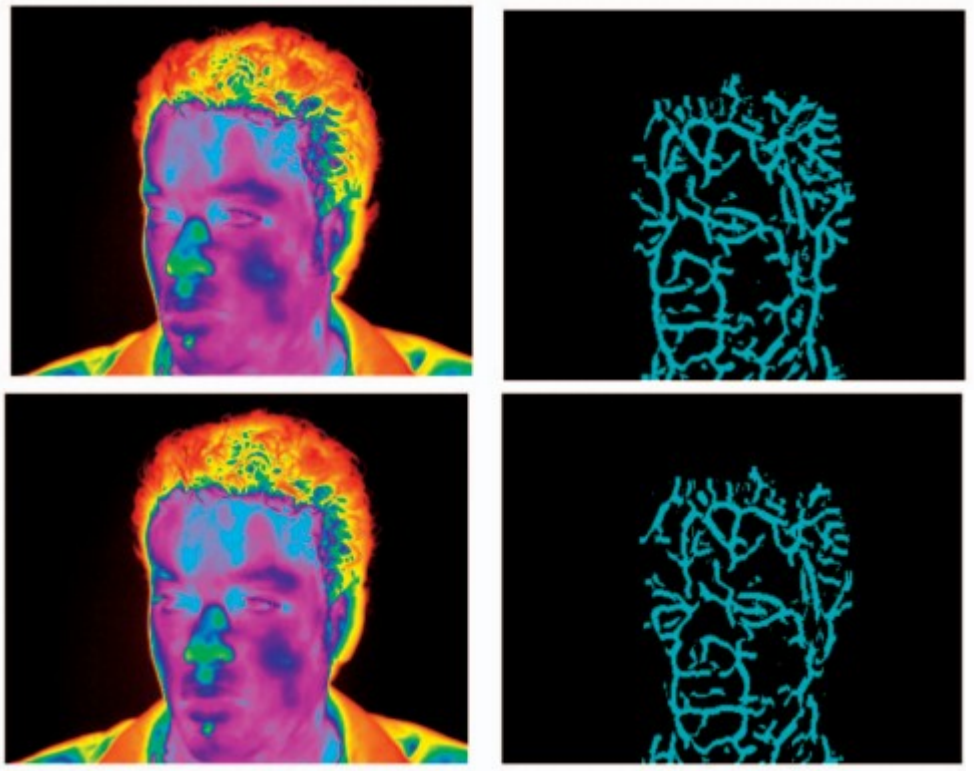
- FPVP (Feature Points of Vein Pattern)
  - Extração de Minutiaes



# Matching

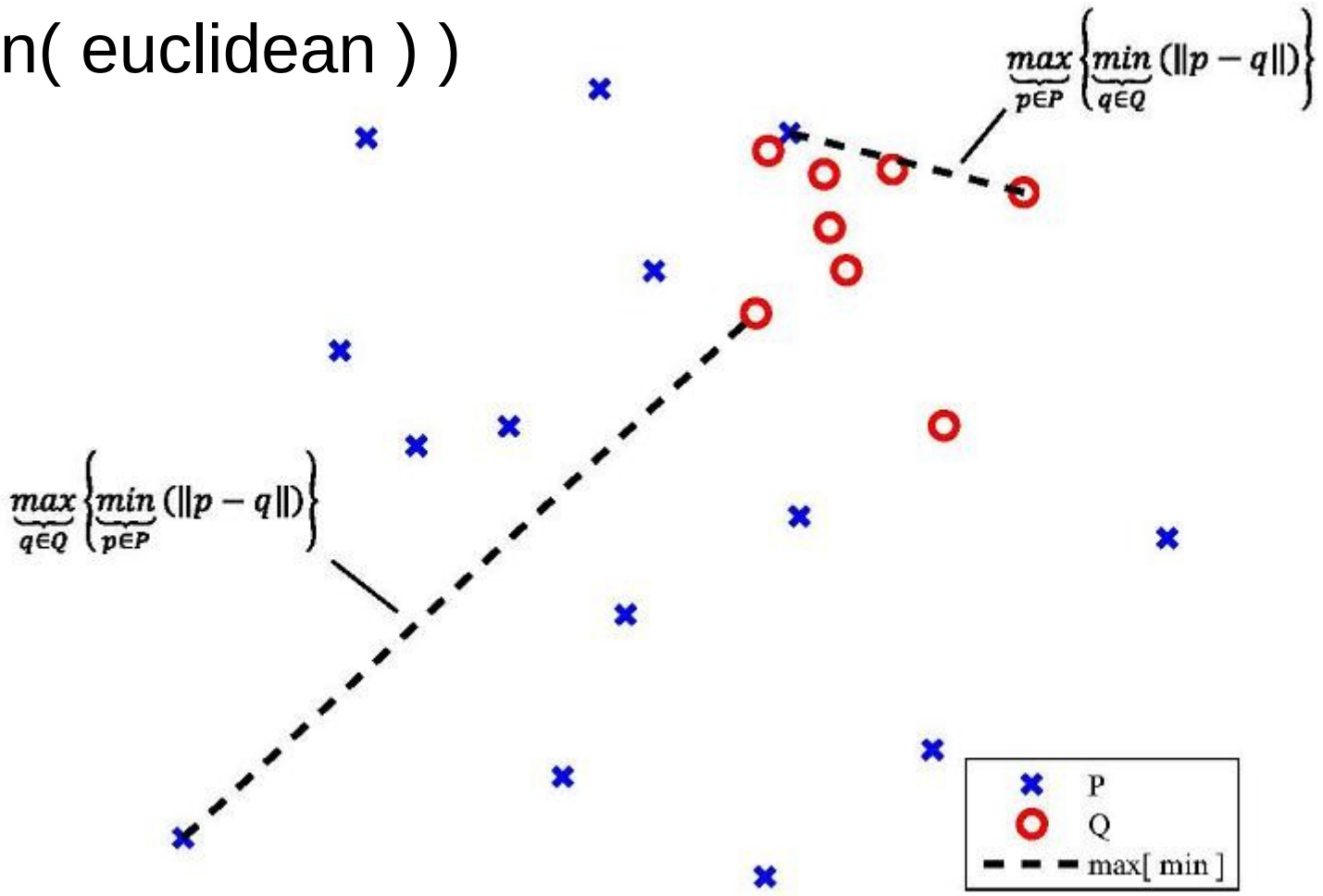
- Alinhar para Comparar
  - Rotação
  - Translação
  - Posição 3D



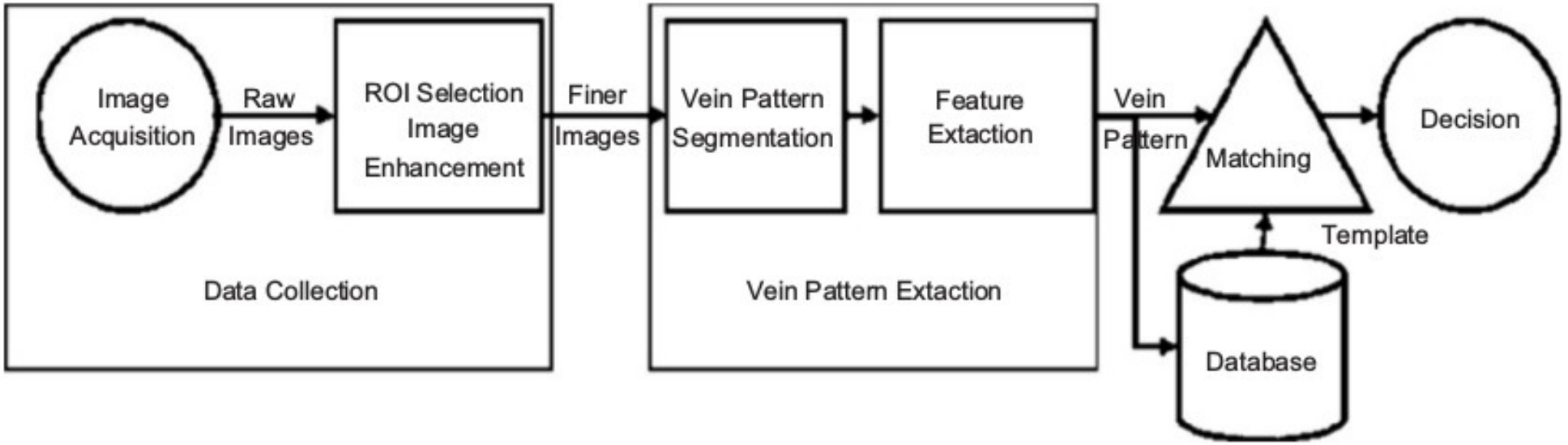
# Matching

- MHD (Modified Hausdorff Distance)
  - max( min( euclidean ) )



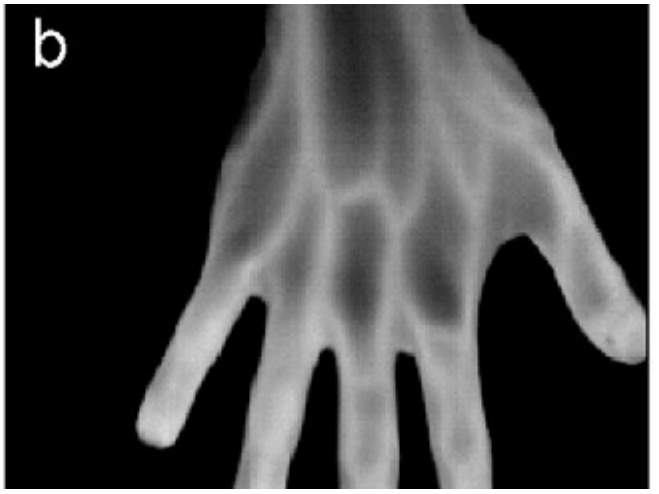
# Paper – Análise de Veias em Mão

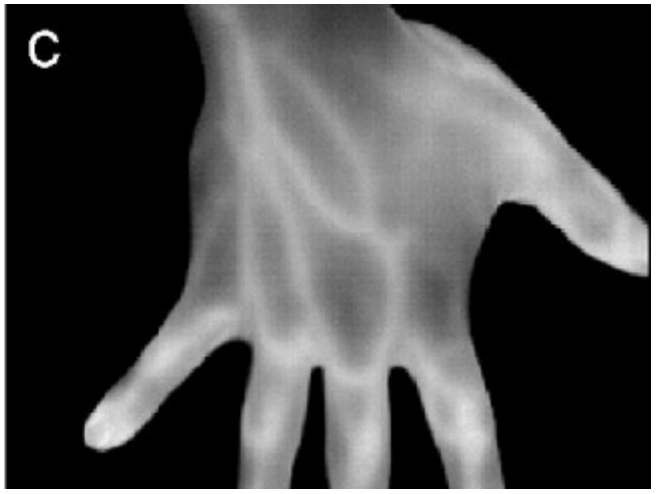
- “Minutiae feature analysis for infrared hand vein pattern biometrics”
- Lingyu Wang, Graham Leedham, David Siu-Yeung Cho
- Pattern Recognition, v. 41, i. 3, p. 920–929, 2008.



# Paper – Análise de Veias em Mão

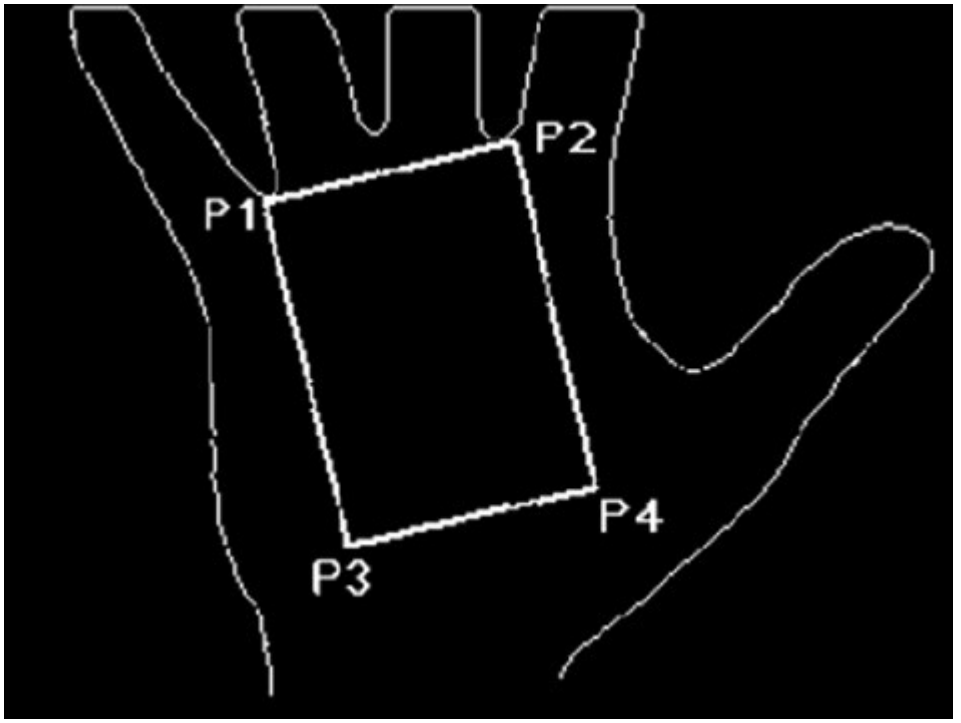
- Database Própria
  - Aquisição FIR
  - 47 participantes
  - 141 imagens
  - Grupos raciais: Chineses, Indianos e Caucasianos
  - Idade: 18 a 60





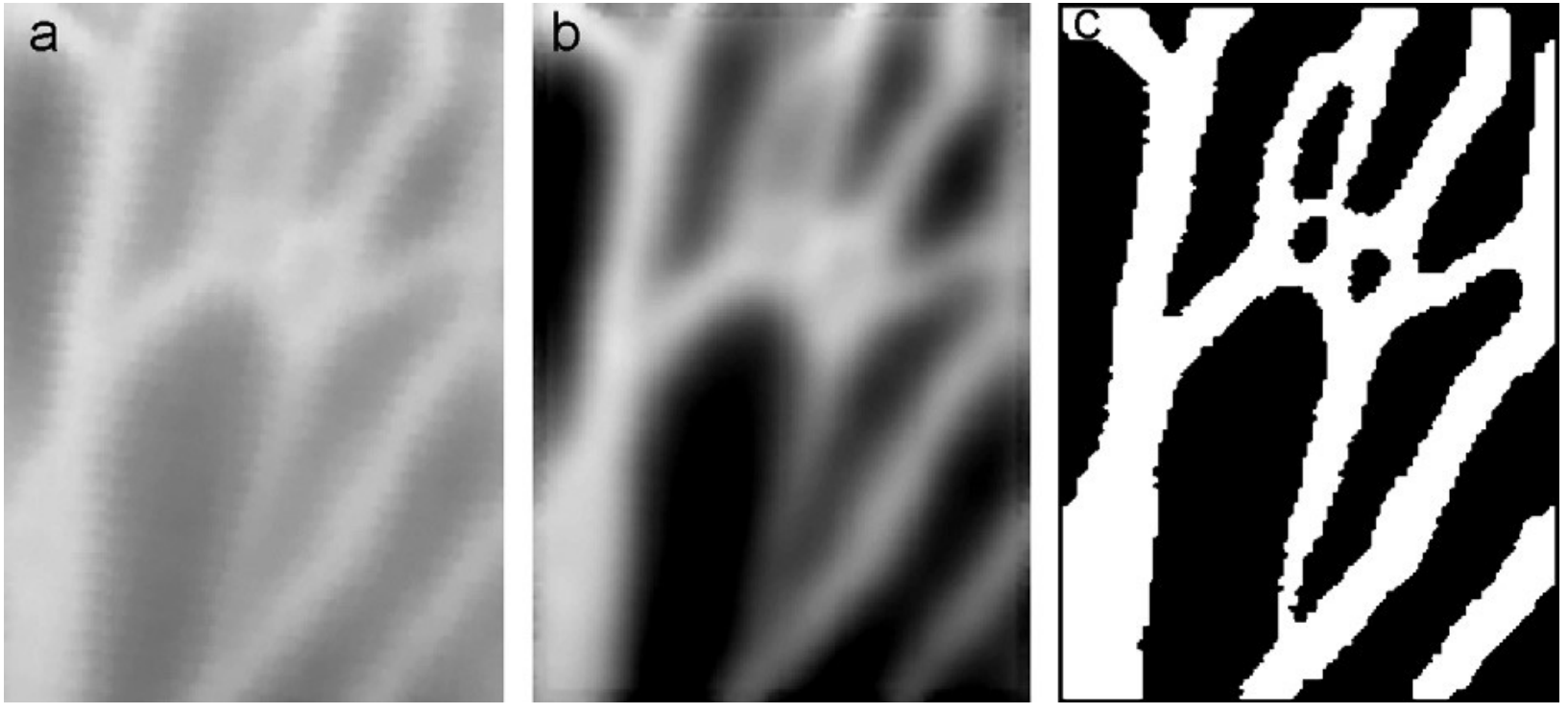
# Paper – Análise de Veias em Mão

- Region of Interest
  - P1 e P2 = valley points
  - ||P1 – P3|| = 1.4 * ||P1 - P2||



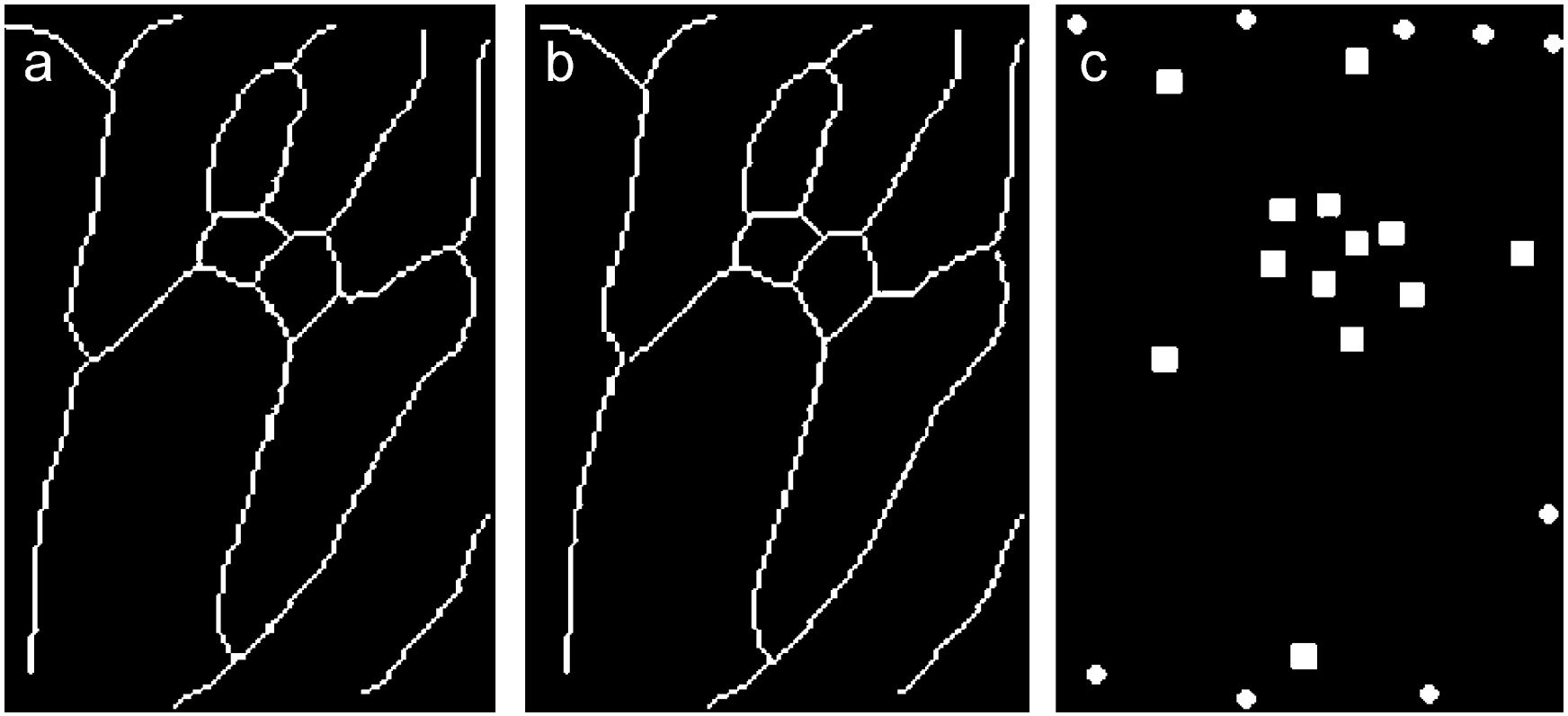
# Paper – Análise de Veias em Mão

- Image Enhancement
  - Median Filter 5x5 (ruído granular)
  - 2D Weiner Filter (ruído de alta frequência)
- Binarization (Global + Adaptative)



# Paper – Análise de Veias em Mão

- Skeleton
- Smoothing (Polynomial Curve Fitting)
- Minutiae Extraction (Transitions)



# Paper – Análise de Veias em Mão

- Resultados
  - Verificação com MHD
  - EER (FAR x FRR)

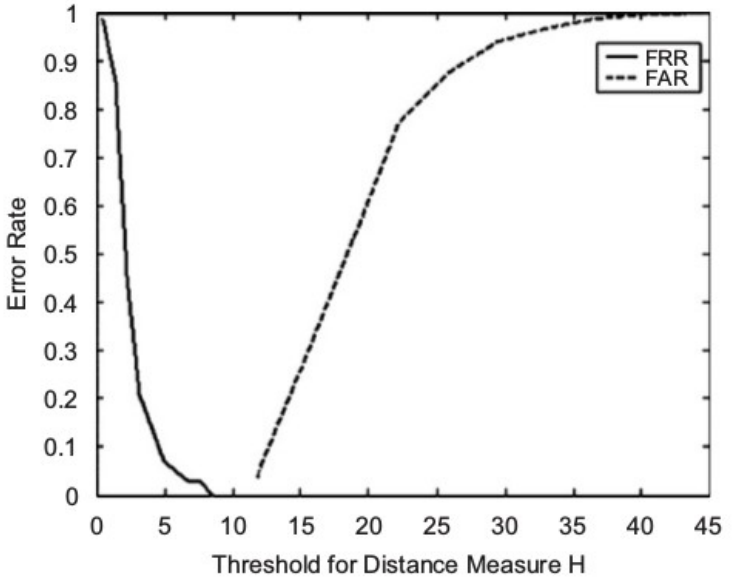



Table 1
Minutiae evaluation using MHD

| | Equal error rate (%) | Threshold value found |
|---|---|---|
| Bifurcation points only | 2.1 | 11.5 |
| Ending points only | 2 | 11 |
| Combination of both minutiae | 0 | 10 |

# Paper – Análise de Veias em Mão

- Análise de Perda de Minutiaes
- Análise de Variação Geométrica (5º)
  - EER 15%, H = 13

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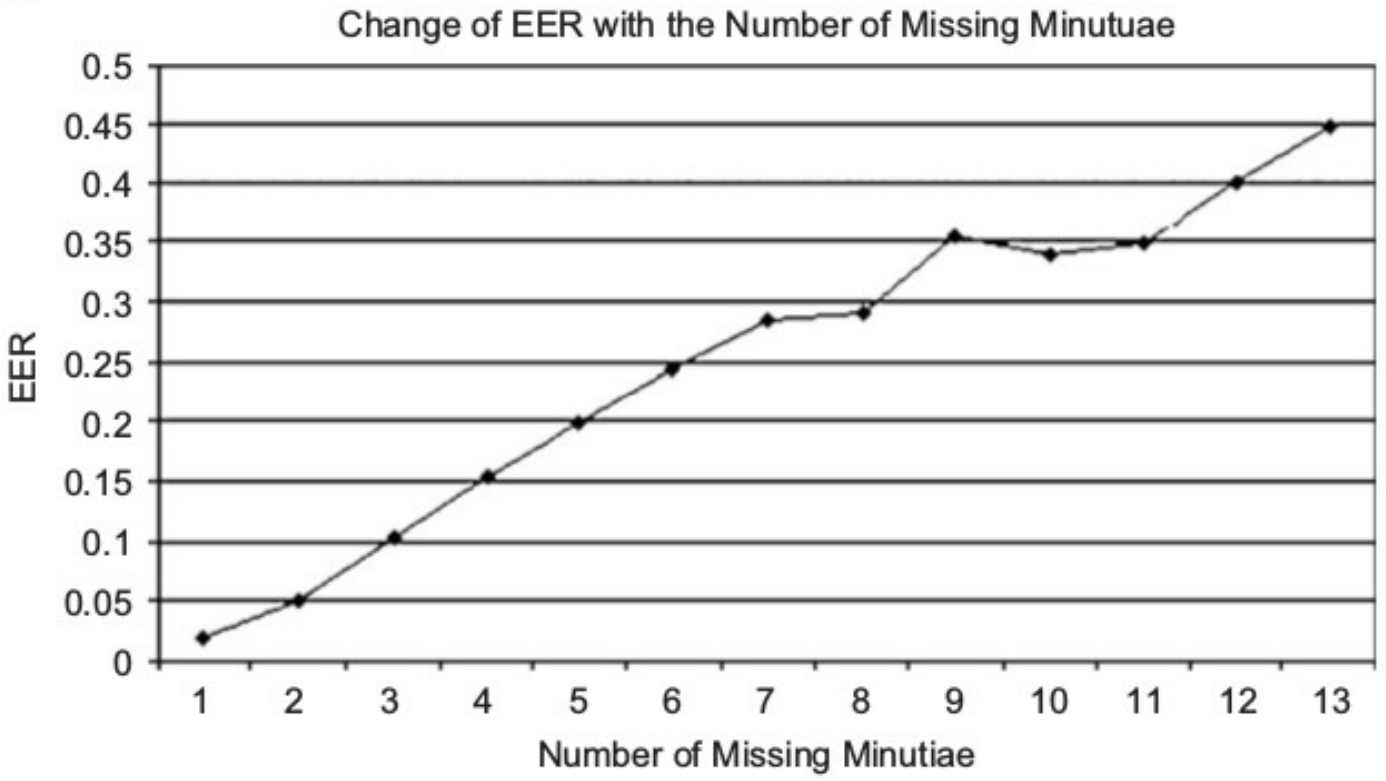

# Referência


- http://www.inquisitr.com/846786/thermal-imaging-next-big-thing-in-biometric-security/
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- WANG, L.; LEEDGAM, G. Near- and Far- Infrared Imaging for Vein Pattern Biometrics. IEEE International Conference on Video and Signal Based Surveillance, 2006.
- BUDDHARAJU, P.; PAVLIDIS, I.; TSIAMYRTZIS, P.; BAZAKOS, M. Physiology-Based Face Recognition in the Thermal Infrared Spectrum. IEEE Transactions on Pattern Analysis and Machine Intelligence, v. 29, n. 4, 2007.
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- WANG, L.; LEEDGAM, G.; CHO, D. S. Minutiae feature analysis for infrared hand vein pattern biometrics. Pattern Recognition, v. 41, i. 3, p. 920–929, 2008.
- WATNE, K. Thermal imaging of ear biometrics for authentication purposes. Department of Computer Science and Media Technology, Gjøvik University College, Box 191, N-2802 Gjøvik Norway, 2008.