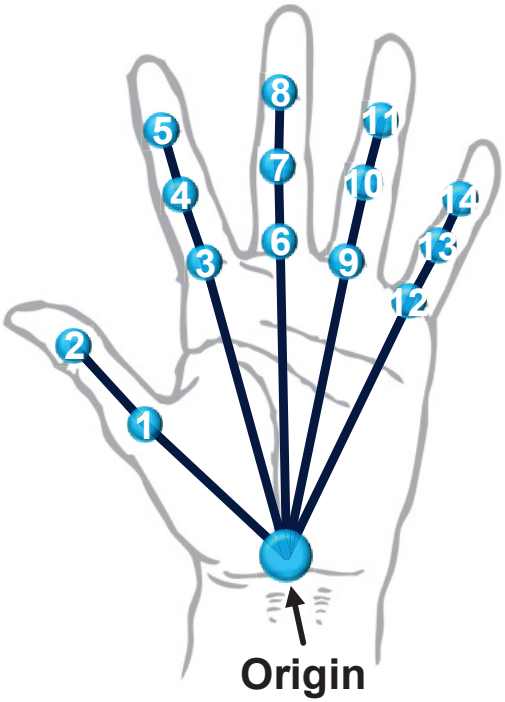
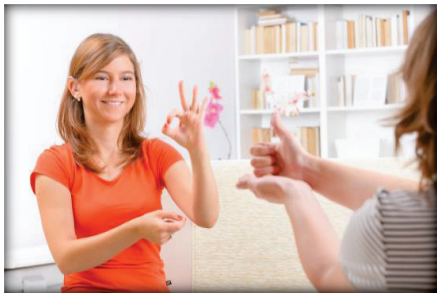
WR-Hand:

Wearable Armband Can Track User's Hand

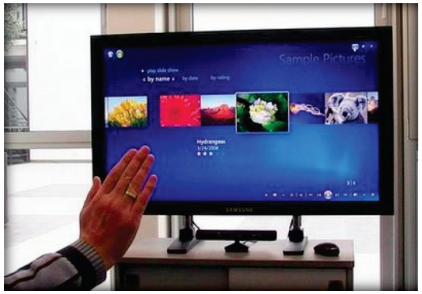
Yang Liu, Chengdong Lin, Zhenjiang Li
City University of Hong Kong

Human Hand Tracking





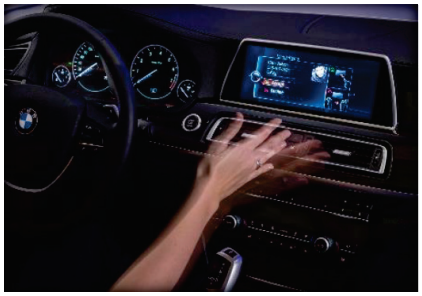
SL Translation



HCI

Gaming

Smart Home



Smart Car

AR/VR

Existing Works

Leap Motion

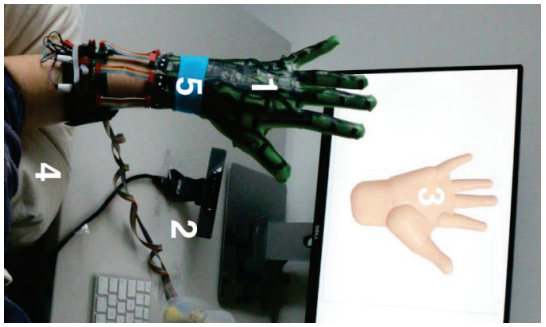
Wearable thermal cameras

Not portable

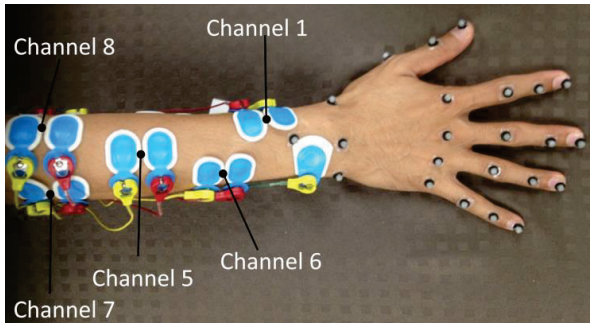
Limited service area

Ambient condition

User Unfriendly

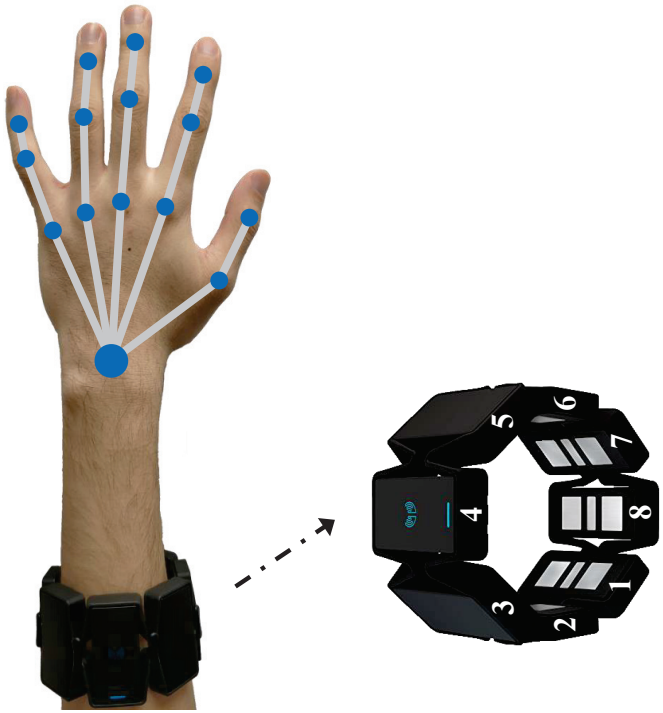


Soft glove

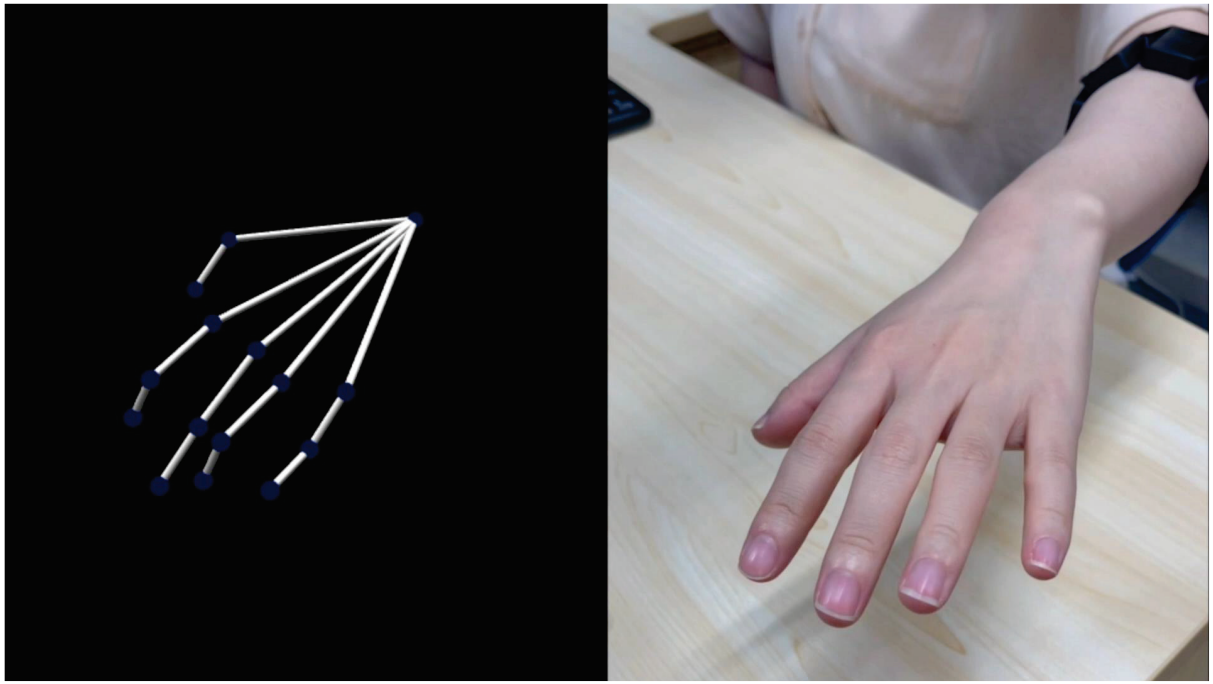


Isolated EMG sensors

Our System: WR-Hand

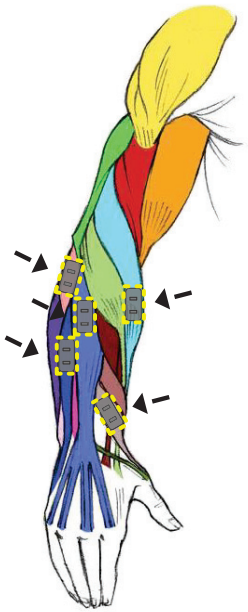


Armband



EMG Sensors

Existing bio-medical models:



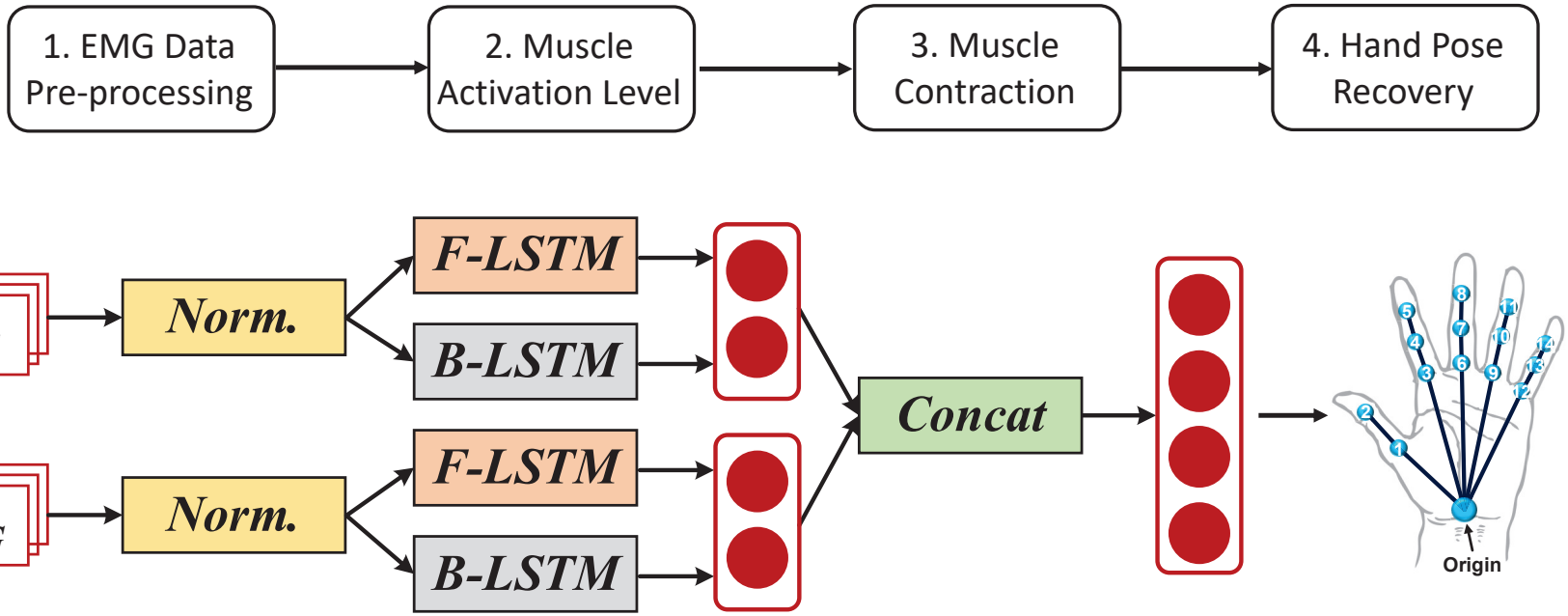
- Sensing specific spots
- Strong signals
- Isolated signals

Using armband:

- Sensing cross-section
- Weak signals
- Mixed signals

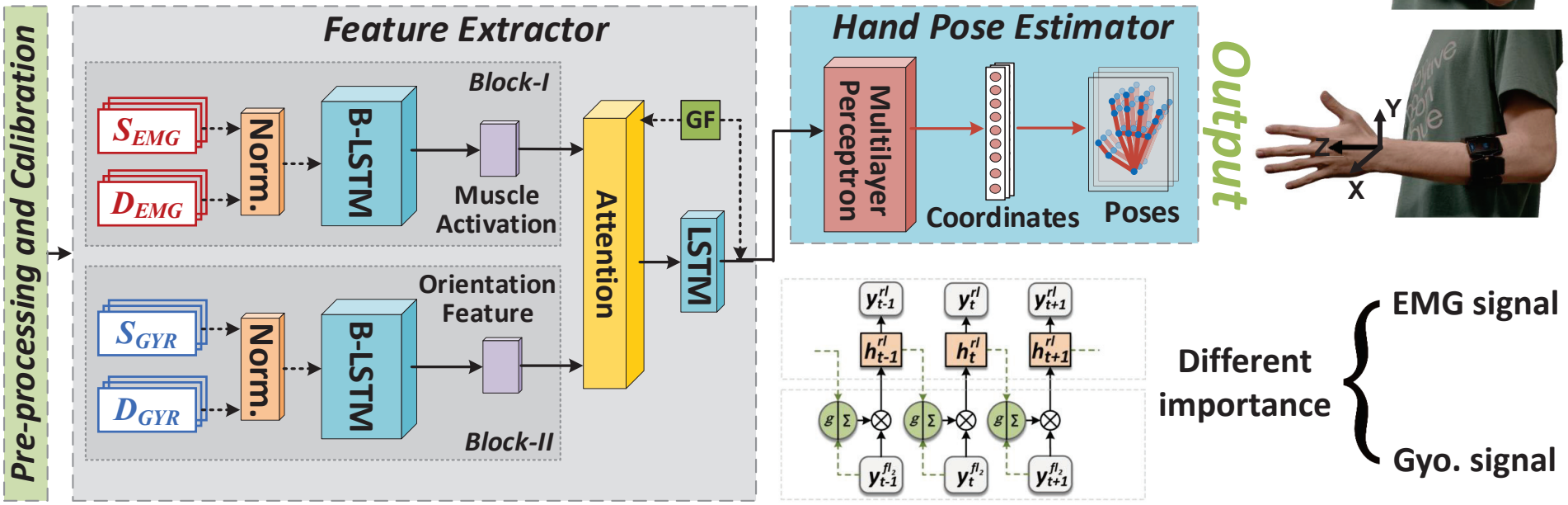
Primary Hand Pose Recovery

- Bio-models meet armband data?
  - Recursive functions → Ineffective
- RNN-enhanced model
  - Following bio-model suggested steps



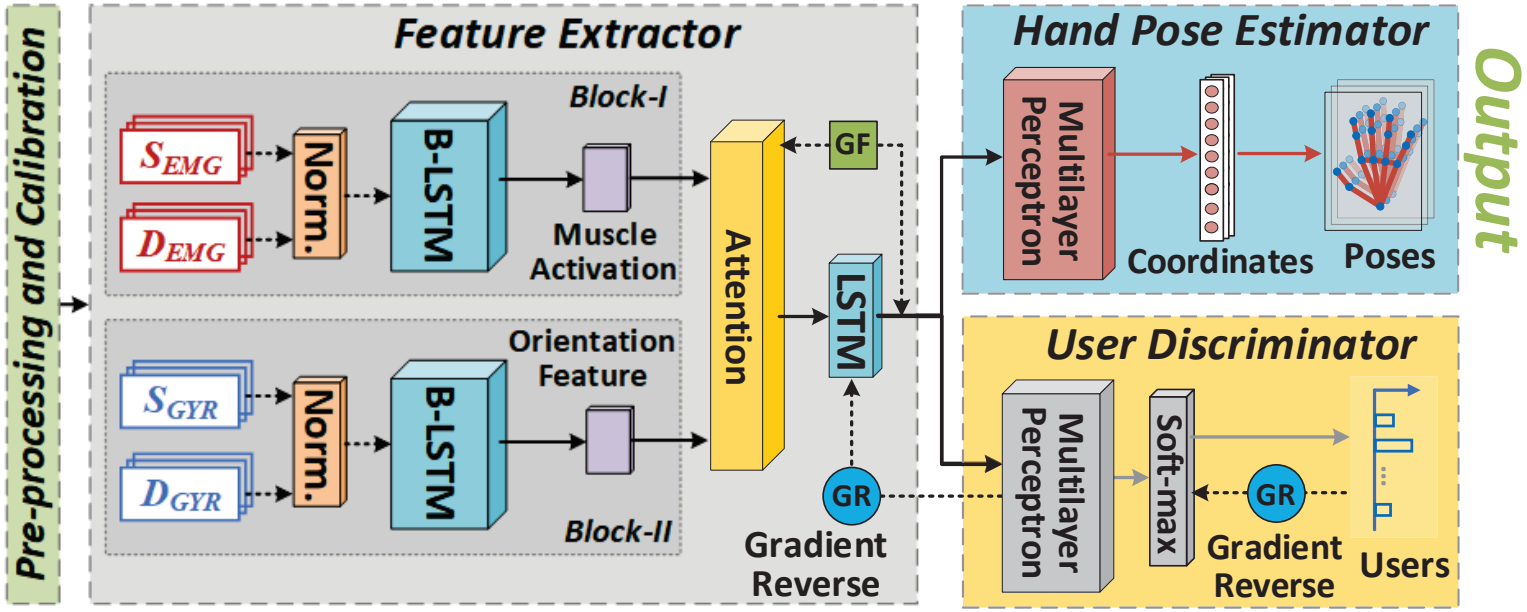
Upgraded Hand Poses

- Place poses in a global coordinate system
  - Forearm orientation



Practical Issue #1: New Users

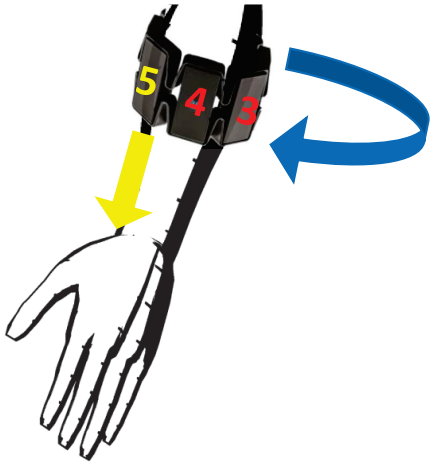
- Remove the user-dependent features
  - Skip training for new users (plug-and-play)

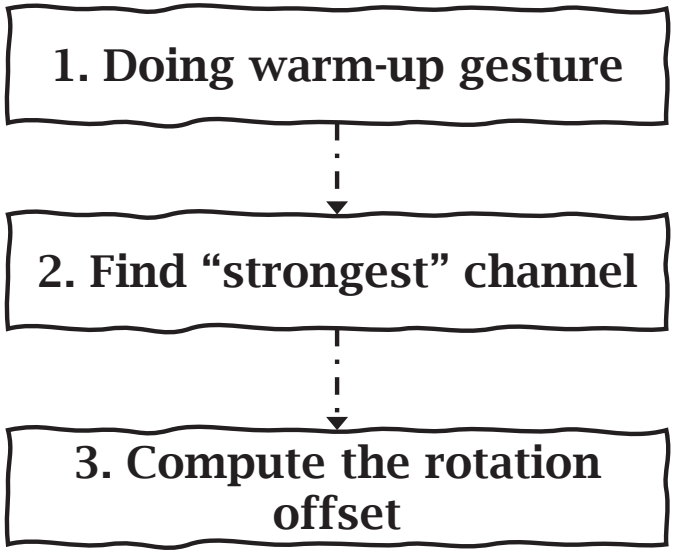


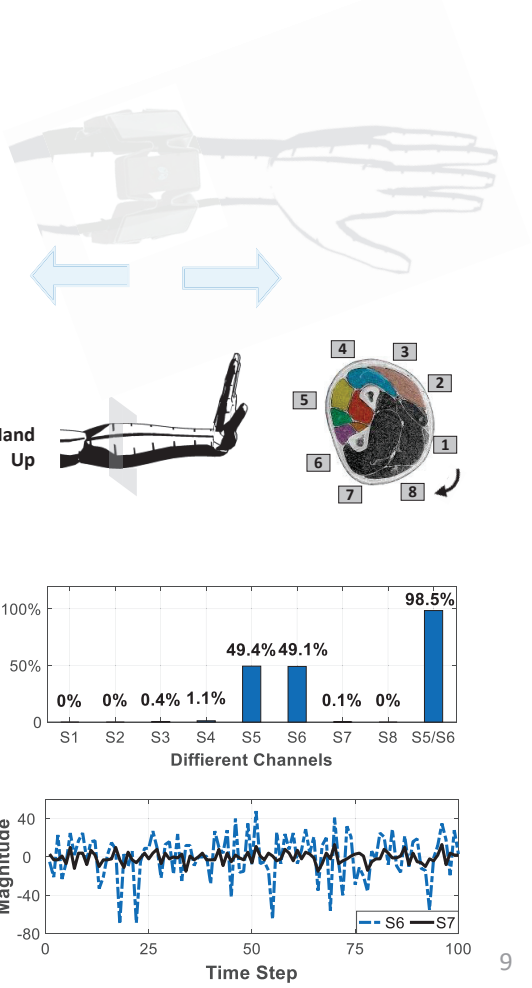
$$L_{loss}(\theta_f, \theta_e, \theta_d) = L_{tra}(\theta_f, \theta_e) - \lambda \times L_{dis}(\theta_f, \theta_d)$$

Practical Issue #2: Armband Position

- Armband wearing-position differences
  - Distance difference → Normalization
  - Rotation difference → Virtual re-ordering



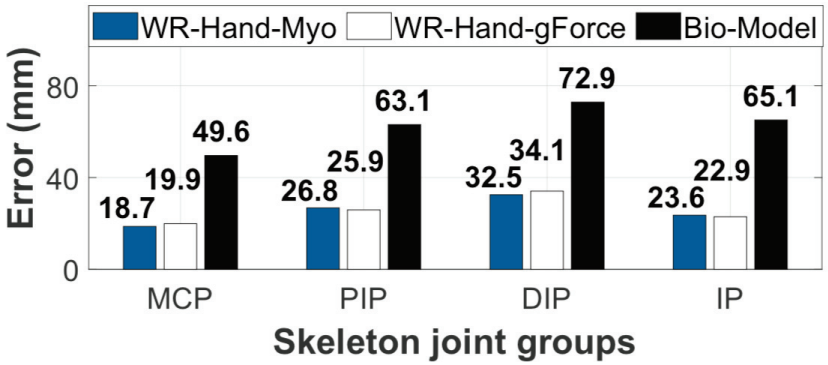




Evaluation

- Two armbands
  - Myo data for training and testing
  - gForce data for testing only
- 18 subjects
  - Data from 10 subjects for training and testing
  - Data from other 8 subjects for testing only

Testing Training



- **Our performance**
  - 2.57cm error using Myo
  - 2.61cm error using gForce
  - >58% error reduction

Conclusion

- Topic:
  - Human hand tracking using a commercial armband
- Design considerations:
  - Hand tracking of 14 skeleton points with arm orientation
  - Plug-and-play version for new users
  - Compensation for armband wearing position

Thank you

Q&A

WR-Hand:

Wearable Armband Can Track User's Hand

Yang Liu, Chengdong Lin, Zhenjiang Li
City University of Hong Kong

CityU
香港城市大學
City University of Hong Kong