NIR spectroscopy for PI detection in all skin tones

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NPIAP 2023 Annual Conference

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Disclosure:
IR-MED co-founders

IR MED
SENSING THE INVISIBLE

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Objectives

- Background of the problem
- Solution - IR sensing of multiple biomarkers
  - Near IR spectroscopy
  - Scanning beneath the skin surface
  - Blood Flow Meter
  - Personalized measurements
  - AI algorithm
- Optical spectroscopy devices by IR-MED
  - POC, PressureSafe scanners

Background – PI in Patients with Dark Skin Tones

- Research shows that people with dark skin tones tend to have*:
  - Higher PI rates
  - Higher risks of mortality from PI
  - More severe PIs

- Lack of knowledge of PI appearance in dark skin tones:
  - Delays early identification and treatment
  - Results in more severe PIs
  - Increases financial costs for healthcare organizations

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It’s time for technology!

*https://www.hmpgloballearningnetwork.com/site/wounds/article/5-year-retrospective-study-descriptors-associated-identification-stage-i-and-suspected-deep

Solution: IR sensing of multiple biomarkers

1. Multiple bio-markers related to PI development in different skin layers
2. Structural changes in different skin layers
3. Blood flow parameter monitoring in the tissue

Equally effective for all skin tones

For detection of Stage 1 PI and sDTI

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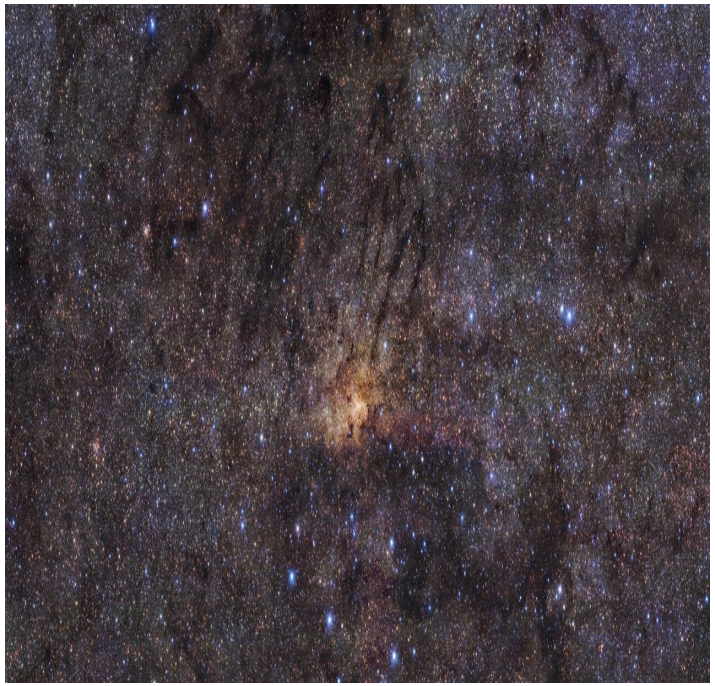
Stars in Space and Pressure Injury



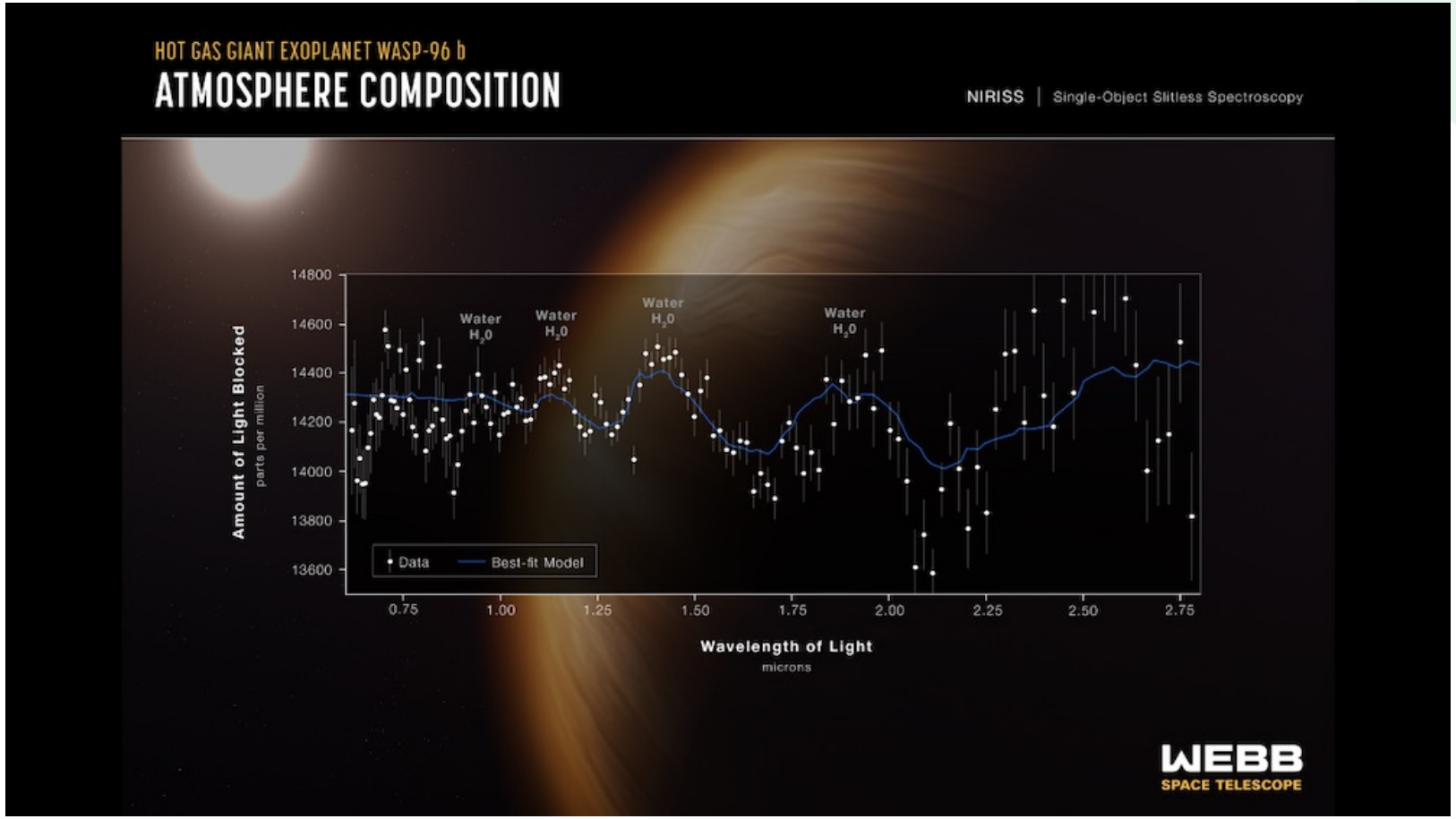
Visual light image of a central region of the Milky Way

The same region in space

Near infrared (NIR) light image of a central region of the Milky Way

https://www.eso.org/public/images/comparisons/eso1920a/

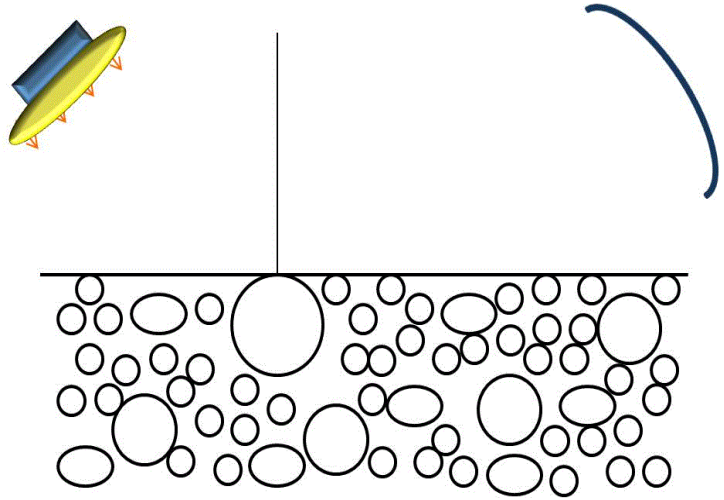
NIR Spectroscopy in Space



25th Dec. 2021
James Webb
space telescope

Diffused Reflectance Optical Spectroscopy

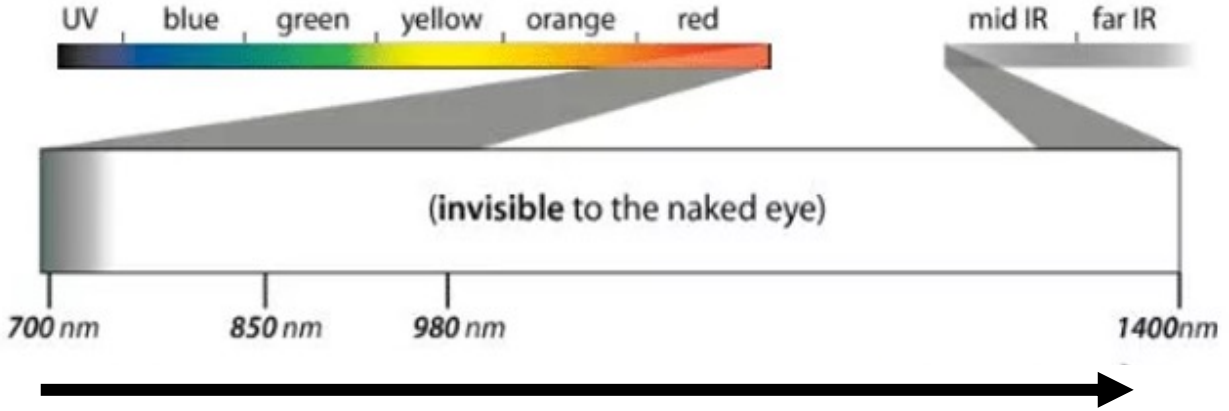
- A non-invasive method that allows in-vivo examination and measurement of the unique optical characteristics of biological tissue
- Optical properties of biological tissue change the spectrum of reflected or transmitted light in accordance with the tissue's structural and chemical composition (chromophore content)
- Chromophores (e.g. collagen, water, oxyhaemoglobin, melanin, etc.)



Near Infrared Spectrum

- Effective for all skin tones (not affected by melanin content)
- Non-invasive
- Harmless light
- Deep penetration into skin layers
- Sensing the invisible – invisible data from important physiological parameters (biomarkers) and tissue structure

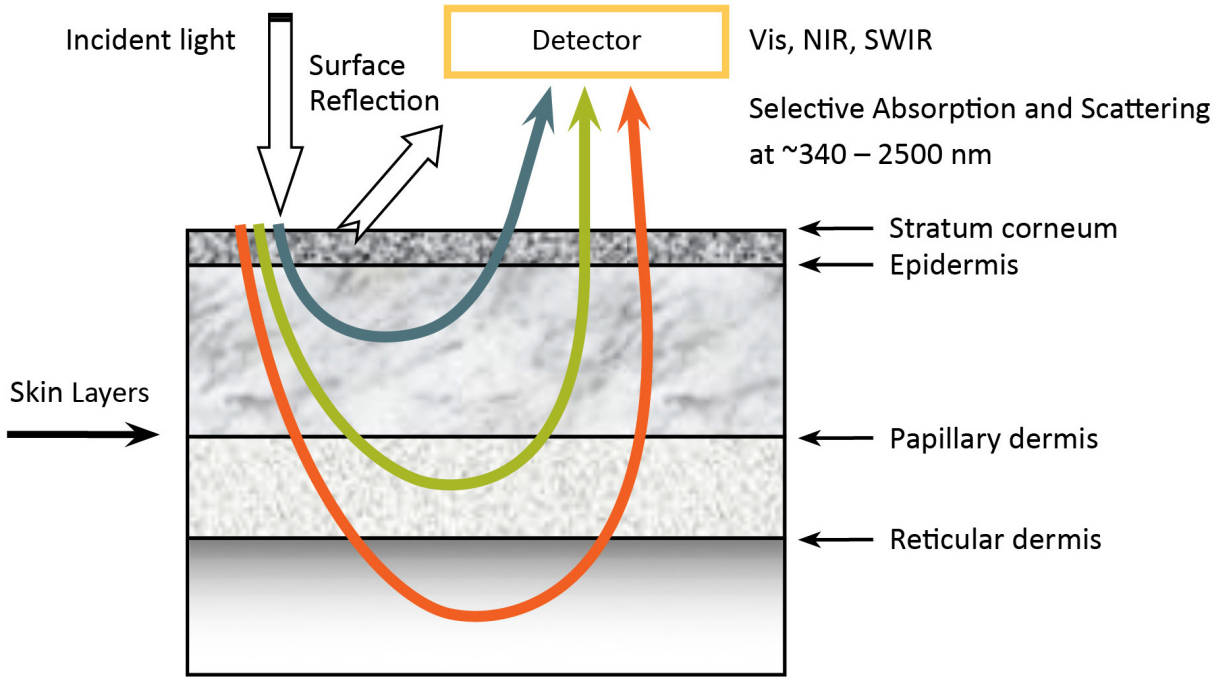
The wavelet of NIR spectrum



Increasing penetration depth

Scanning beneath the skin's surface

- Detecting underlying skin surface changes using multiple optical wavelengths
- Scanning at different layer depths
- Detecting structural changes in different skin layers
- Analyzing the tissue content of different layers



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Blood Flow Meter

- Blood flow measurement is physiologically and clinically important
- Blood flow in PI is different than in healthy tissue
- Measures blood cell perfusion in the microvasculature of tissues and organs
- PPG , Pulse Wave Velocity, Diffused Correlation Spectroscopy, Doppler Flowmetry (DF)

Tamura, T. “Blood Flow Measurement (5.05).” Comprehensive Biomedical Physics 2014: 91–105. Web.

Personalized measurements

- Personal calibration allows reliable & accurate measurement for each patient
- Per patient acquisition of sample measurement from skin reference area with low risk of PI
- This method <u>overcomes:</u>
  1. Skin tone variance between patients
  2. Skin structure variance between patients
  3. Skin structure variance between different measurement sites on the body

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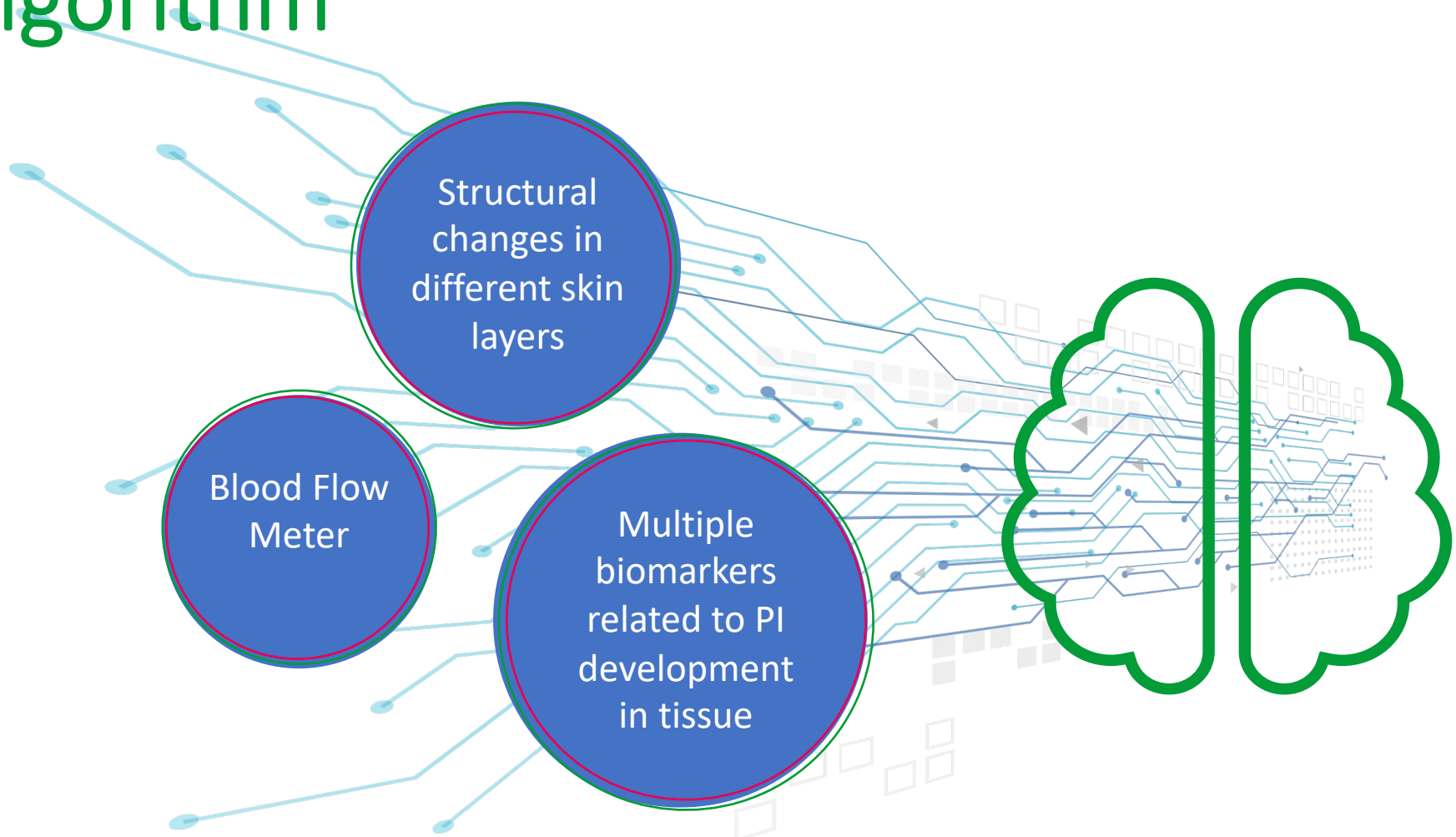
AI algorithm



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For detection of PI stage-1 and sDTI

OPTICAL SPECTROSCOPY DEVICES

IR-MED

From research to clinic

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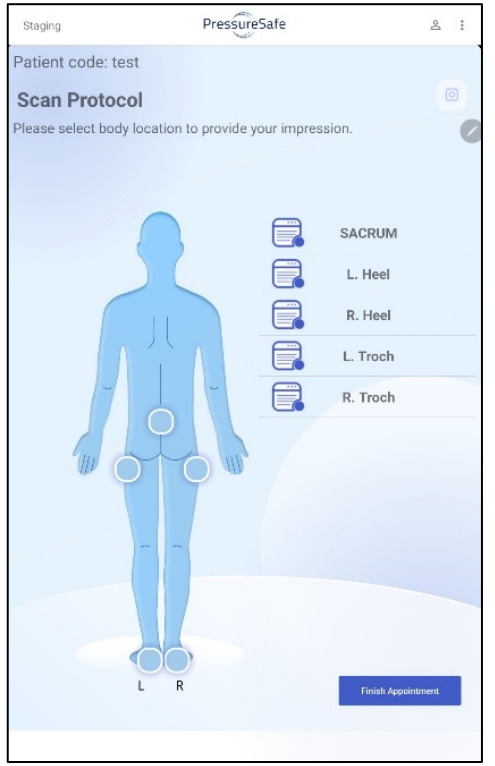
POC – Study

- 2 medical centers in Israel
- Only Stage 1 PIs were included in the trial. Higher grades of PI were excluded.
- PI was diagnosed by certified doctors and scanned by the device
- Total of 76 samples were taken from both medical centers
- **Results:** 94.7% accuracy in identification of Stage 1 pressure injuries

PressureSafe 1st Generation

- Scanner and App
- Handheld electro-optic scanner with tablet and App
- Based on LED's (specific wavelengths) and detectors
- Multiple biomarkers and optical blood flow detector
- For use with patients at increased risk of pressure injury
- Personalized medical device
- Currently undergoing useability studies at 2 medical centers in Israel



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PressureSafe – advanced technology

EFFECTIVE FOR ALL SKIN TONES

DISPOSABLE TIP

EMR/EHR CONNECTIVITY

SCANS BENEATH THE SKIN SURFACE

AI INSIDE

CAMERA FOR DOCUMENTATION

MULTIPLE BIOMARKERS

*Not yet available for commercial use. Expected US launch: H2/2023

Takeaway message - Equity in Prevention PI

- Non-invasive IR sensing of multiple biomarkers – for accurate results
- Personalized medical device – calibrates to each patient's skin
- Scans beneath the skin surface – sensing the invisible
- Near Infrared light – deep penetration, effective for all skin tones
- Scans in different layers and depths – to detect structural changes
- AI – machine learning algorithm

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References

- https://www.eso.org/public/images/comparisons/eso1920a/
- Tamura, T. “Blood Flow Measurement (5.05).” Comprehensive Biomedical Physics 2014: 91–105. Web.
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- Cohen, Y., Dekel, B.Z., Yuldashev, Z., Blaunstein, N. (2022). NIR-SWIR Spectroscopy and Imaging Techniques in Biomedical Applications—Experimental Results. In: Czarnowski, I., Howlett, R.J., Jain, L.C. (eds) Intelligent Decision Technologies. Smart Innovation, Systems and Technologies, vol 309. Springer, Singapore. https://doi.org/10.1007/978-981-19-3444-5_11

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Thank you !

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