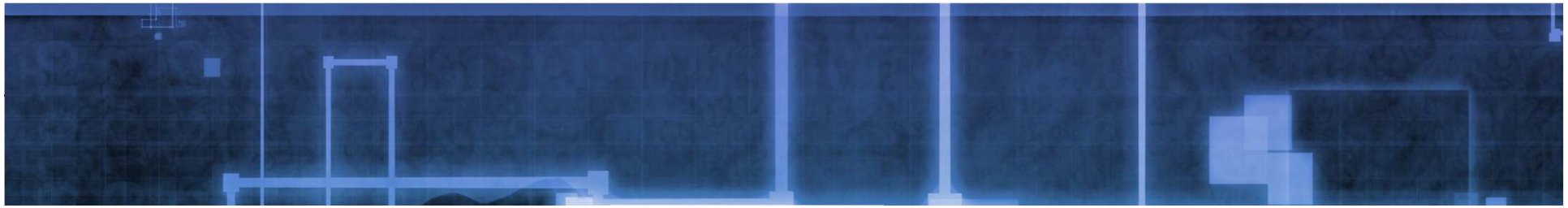


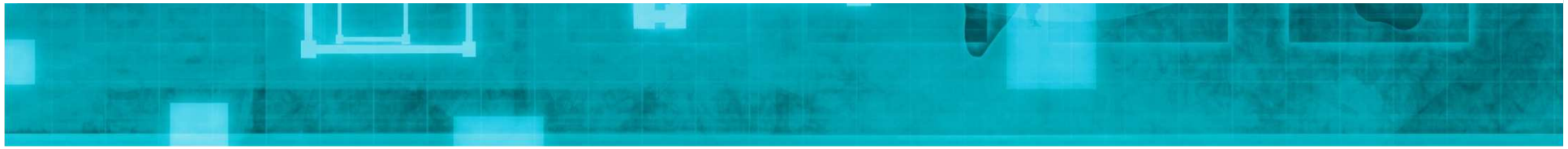
Horizon 2020 Secure Societies European Info Day and Brokerage Event

Brussels , 6-7 March 2017

National Aerospace University "KhAI"

Ukraine

Dr. Lina Smovziuk (l.smovziuk@khai.edu)



National Aerospace University “KhAI”

- *Leading technical University in Ukraine*
- *1000+ research and academic staff*
- *2 FP6, 5 FP7, 2 H2020 aerospace projects*
- *Multi-disciplinary Research Team:*
  - ✓ *Strong R&D capabilities in radars, remote sensing and signal processing*
  - ✓ *International reputation and connections*
  - ✓ *Innovative approaches and ideas*
  - ✓ *Active and open for collaboration*

Co-funded by the Horizon 2020
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ADVANCED RADAR BORDER SURVEILLANCE SYSTEM

for through-foliage detection, recognition & classification of moving objects

BASED ON BISPECTRAL SIGNAL PROCESSING

- ***Foliage Penetration Surveillance Systems – SoA:***
  - UHF/VHF Airborne SAR systems (e.g. CARABAS, FORESTER)
  - Ordnance, vehicles, NOT humans
  - Expensive, weather-dependent, non-24/7
- ***Innovative idea:***
  - Highly-effective Radar Border Surveillance System
  - Bispectral signal processing algorithms for moving objects detection
  - New classification features extracted from bispectral/bicoherence data

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Bispectral Signal Processing

Principle:

- *Both **energy and phase information** in radar backscattering **matters**!*
- *Target object backscattering **contains phase-coupled contributions***
- *Vegetation clutter interference – **NO phase-coupled contributions***

Advantages:

- *Radical suppression of vegetation clutter interference*
- *Reliable object detection (up to 85%) of moving human with low false alarms rate*

Proven for:

- *Mm/cm wavelength, 15 mW, horizontal and vertical polarization*

To be scaled for:

- *Dm/m wavelength, 10-100 mW*

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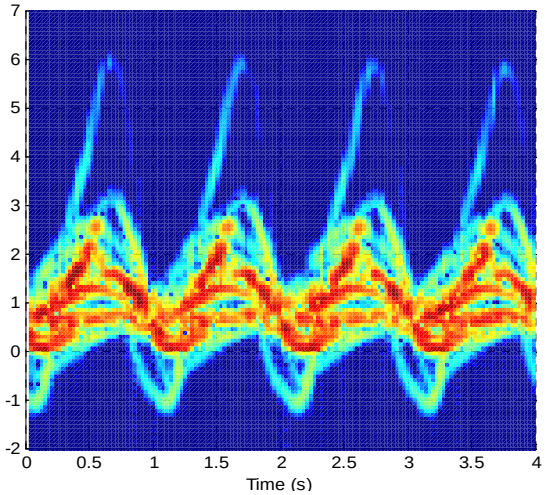
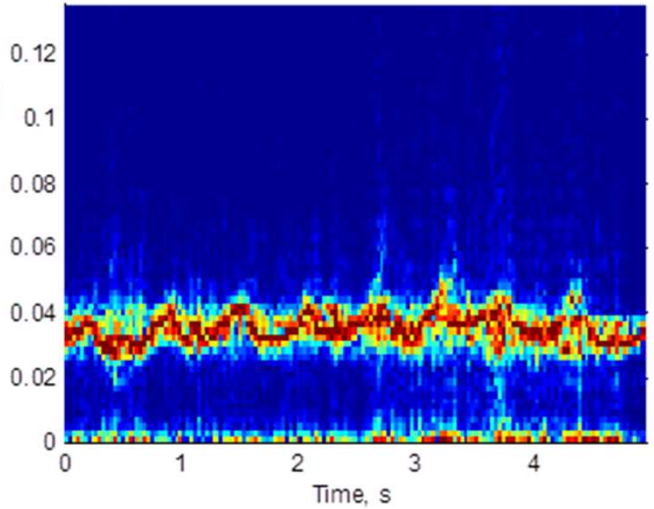
Ground Moving Target Detection

Walking man in open terrain

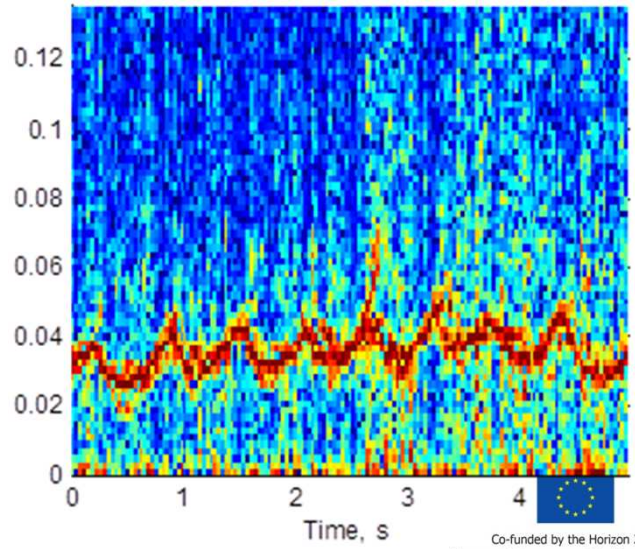


Bispectrum-based signal processing
$B_x(f_1, f_2)$



Through-foliage detection of walking man

Energy-based signal processing
$P_x(f)$



*Time-frequency radar signatures of walking man (experimentally obtained by KhAI)

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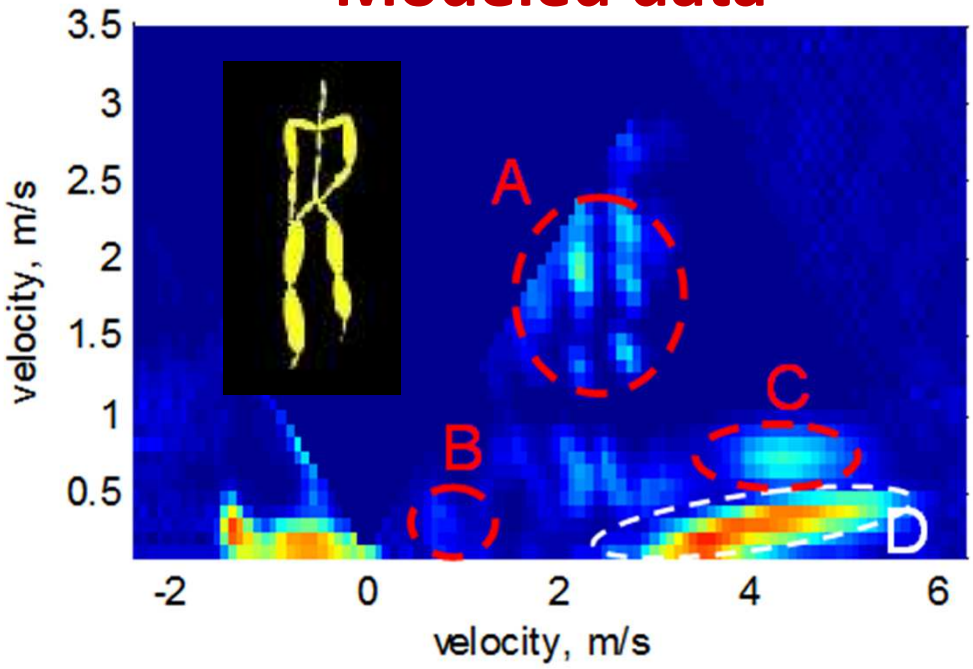
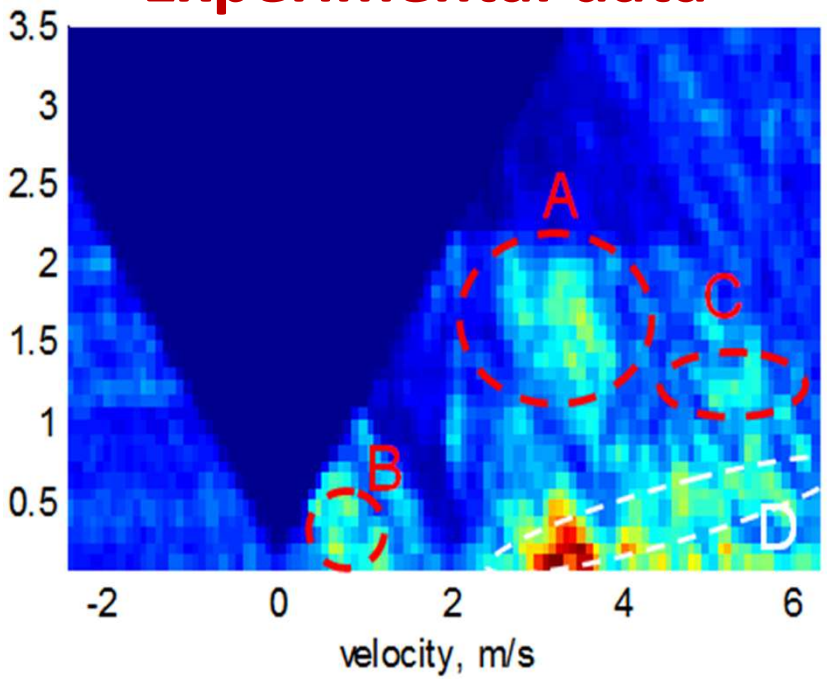
Ground Moving Target Recognition

Potential targets: single man, group of people, wheeled vehicle, bicyclist, animal, etc.

Modeled data



Experimental data



Bicoherence radar signature for through-foliage detection of walking man:
A – torso; B,C,D - other body parts

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SEC-16-BES-2017: RIA (TRL 5-6), 8 M€

Project aim:

- To develop, validate and demonstrate advanced Radar Border Surveillance System for reliable through-foliage detection, recognition and classification of moving objects due to bispectral signal processing algorithms application

Expected results = outcomes:

- Integrated radar border surveillance system concept
- Prototypes of border surveillance system components
- Innovative bispectrum-based signal processing algorithms + corresponding ATR software

Impact:

- Improved EU border surveillance in forested regions
- Facilitated protection of EU frontiers against penetration of illegal migrants.

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Required partners:

- ***R&D partners:***
  Research teams experienced in digital signal processing and pattern recognition techniques
- ***Industrial/SME partners:***
  Radar systems manufacturers + ATR software developers
- ***End Users:***
  EU border surveillance authorities (3+ case studies in various EU regions, incl. outermost ones)
- ***EU Coordinator!***

OR

Ready to join SEC-16-BES-2017 consortium!

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Dr. Lina Smovziuk
National Aerospace University “KhAI”
International Projects & Programmes Office
Tel: +38 057 788 40 22
E-mail: l.smovziuk@khai.edu
Web: www.khai.edu