Wearable, Mobile, and Fixed-Location Technology by Sport for Coaches and Trainers

The New Home Field Advantage: Part 2
Fitness & Sports Wearable Technology (FAST) Expo II, July 22, 2014
Robert A. Connor, MHA, Ph.D., CEO, Medibotics LLC
robert.connor@medibotics.com
"Don't look back. Something might be tracking you."

(inspired by Satchel Paige)
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Motion Metric (function of change in location)

Physiological Metric (function of heart, respiration, other)

Time
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"Win at Home and Draw Away"
Automatic Formation Analysis Highlighting the Differences in Home and Away Team Behaviors

Bialkowski et al. (2014),
MIT Sloan Sports Analytics Conference, Feb-Mar, 2014

* Soccer. Two factors. (1) **Team formation** (e.g., 4-4-2, 4-2-3-1, 3-5-2 etc.). (2) **Manner of execution** (e.g., conservative -- sitting deep, or aggressive -- pressing high).

* Season of Prozone data. **Ball and player tracking**. Top-tier professional league. **Automatic formation detection** method. Investigate “home advantage.”

* Teams tend to play same formation at home as away, but execution of formation is different.

* Position of **team significantly higher up the field at home** compared to away. Conservative approach away suggests coaches aim to win home games and draw away games.
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FUTURE TECH?
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Future Mobile Full-Body Motion Recognition?

Shoulder (each) Longitudinal Sensors:
- 1 upper long, 1 upper short, 1 lower long, 1 lower short
- 1 front long, 1 front short, 1 back long, 1 back short

Elbow (each) Longitudinal Sensors:
- 1 inner long, 1 inner short, 1 outer long, 1 outer short
- 2 central twist long

Torso Longitudinal Sensors:
- 2 side long, 2 side short,
- 3 central twist front long, 3 central twist back long

Hip (each) Longitudinal Sensors:
- 1 front long, 1 front short, 1 back long, 1 back short,
- 2 side long

Knee (each) Longitudinal Sensors:
- 1 front long, 1 front short, 1 back long, 1 back short,
- 2 side long
Soccer(US)=Football(Intl.): Companies and Applications

**TECH MODE: COMPANY/PRODUCT:**

- Wearable ► Adidas/miCoach
- Wearable/Mobile/Fixed ► Cairo Tech
- Wearable ► Catapult Sports
- Fixed ► Deltatre/Metrics
- Fixed ► STATS LLC/SportVu
- Fixed ► SUP/Prozone
- Fixed ► HawkEye
- Mobile/Fixed ► GoalRef
- Fixed ► Match Analysis/K2 Panoramic Video
- Wearable ► MC10/Biostamp?
- Wearable ► Beestar/QuASP
- Wearable ► Google/Glass?
- Wearable/Mobile ► Panasonic/HX-A500
- Wearable/Mobile ► SAP/HANA
Basketball: Companies and Applications

**TECH MODE: COMPANY/PRODUCT:**

- Fixed ➤ STATS LLC/SportVU
- Wearable ➤ Catapult Sports
- Wearable ➤ Digital Sports/ShotTracker
- Wearable ➤ Hoop Tracker
- Mobile ➤ Infomotion Sports/94Fifty
- Wearable ➤ Vibrado
- Wearable ➤ Zephyr/BioPatch?
Baseball: Companies and Applications

**TECH MODE: COMPANY/PRODUCT:**

- Fixed ➤ Sportvision/PITCHfx
- Fixed ➤ Sportvision/HITfx
- Fixed ➤ STATS LLC/SportVU
- Mobile ➤ Blast/Swing Trainer
- Wearable ➤ Catapult Sports?
- Wearable ➤ MC10/Biostamp?
- Wearable ➤ Northeastern/Pitcher Shirt?
- Mobile ➤ Zepp/Baseball
Football(US): Companies and Applications

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<td>Wearable ► i1 Biometrics</td>
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<td>Wearable ► Mamori/Mouthguard</td>
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<td>Fixed ► Sportvision/Optical Player Tracking</td>
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<td>Wearable ► X2 Biosystems</td>
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<td>Wearable ► Zebra Technologies</td>
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<td>Wearable ► Alert Shirt</td>
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<td>Wearable ► Real Track Football</td>
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[article] Solomon (2013), "SEC, Pac-12 and Big 12 will Electronically Track Football Players' Speeds and Movements"
Fitness/Strength Training/Running:
Companies and Applications

► Adidas/miCoach ► Fitbit ► Intel/Basis Science ► Jawbone/BodyMedia
► Nike/Fuelband ► Sensoria/Smart Socks ► Carre/Hexoskin
► **PUSH Design/Armband** ► Clothing Plus+ ► Misfit/Shine ► Moov
► New Balance/Cardio ► OMsignal/Shirt ► Polar ► Samsung/Galaxy Fit
► Thalmic Labs ► Under Armour ► Zephyr ► Amiigo ► Athos ► Bowflex/EX
  Pro ► Fitbug ► FitLinxx ► Garmin ► Gruve/Muve ► Lumo BodyTech
► Neptune/Pine ► Notch ► Preventice ► Qualcomm ► Reebok ► Runner
  Groove ► Samsung/Galaxy Gear ► SONY ► TITIN/Shorts ► Ware LLC
► Withings/Pulse ► LG/Lifeband ► Google/Watch? ► Microsoft?
► Samsung/Simband? ► Google/Glass? ► Apple?
Golf: Companies and Applications

TECH MODE: COMPANY/PRODUCT:

Wearable/Mobile ► Active Mind/Game Golf
Mobile ► Mobiplex/SwingTIP
Wearable ► Zepp/Golfsense
Fixed ► GolfTEC
Mobile ► GreenPlay
Wearable ► Medibotics?
Mobile ► Seiko Epson/M-Tracer
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Other Wearable Tech:

► 3DSuit/Innalabs ► AiLive ► AiQ/Smart Clothing ► Animazoo ► APDM
► Applied Technology Holdings ► Autographer ► Biomedtrics ► Biopac
► Dynamic Athletic Research Inst. ► EMGSrus/Motion Lab ► Heapsylon
► Impact Sports Technologies ► Innalabs/3DSuit ► InterSense ► iON Air
    Pro Camera ► K-Motion Interactive ► MicroStrain ► Midland Action
    Camera ► Narrative Clip ► NeuroSky/MindWave ► Neurowear
► Noraxon ► NDI/Ascension ► Parashoot ► Physical Enterprises
► Pivothead ► Plantronics ► Polhemus/Alken ► Tactonic Technologies
    ► TechnoSkin ► Trakus ► Xsens ► ZXY Sport Tracking
Other Fixed Location Tech:

► Active Analysis ► B & L Engineering ► Charnwood Dynamics
► ChyronHego ► Elite Sports Analysis ► EON Reality ► Kizanaro
► MasterCoach ► Mikromak ► Motion Analysis Corporation ► Motion Reality
► Pfinder ► Scanball ► Sports Data Hub ► SportsBoard ► Vicon ► Vuzix
Bialkowski et al. (2014), "Win at Home and Draw Away" Automatic Formation Analysis Highlighting the Differences in Home and Away Team Behaviors, MIT Sports Conference.
Basak (2014), "U.S. Soccer Team Tracks Movement to Prevent Onset of Injury"
Fonseca et al. (2012), "Spatial Dynamics of Team Sports Exposed by Voronoi Diagrams", Human Movement Science
Frencken et al. (2011), "Oscillations of Centroid Position and Surface Area of Soccer Teams in Small Sided Games", European Journal of Sport Science
Frencken et al. (2012), "Variability of Inter-Team Distances Associated with Match Events in Elite-Standard Soccer", Journal of Sports Sciences
Oliver et al. (2013), "Assessing Team Strategy Using Spatiotemporal Data", 19th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining
Reilly et al. (2007/2009), Science and Football VI, the Proceedings of the Sixth World Congress on Science and Football
Siegle (2013), "Design of an Accuracy Study for Position Detection in Football", J of Sports Sciences
Basketball: Articles for Tech-Related Analysis and Strategy
mainly using STATS LLC/SportVU data


Boudway (2013), "The NBA Will Now Track Every Player's Movements", Business Week


Dubin (2012), "Basketball Enters the Space Age", ESPN.go.com (TrueHoop)


Lowe (2013), "A New View: The NBA Will Install STATS LLC Cameras in Every Arena in the League", Grantland

Lowe (2013), "Lights, Cameras, Revolution", Grantland

Lowe (2013), "Seven Ways the NBA's New Camera System Can Change the Future of Basketball", Grantland

Lowe (2013), "The SportVU Follow-up: Answering the Most Common Questions…", Grantland

Maheswaran (2012), "Deconstructing the Rebound with Optical Tracking Data", MIT Sports Conference


Mason (2011), "Optical Tracking Data and the Importance of Screening in the Boston Celtics' Offense", Hoopspeak.com

Maymin (2013), "Acceleration in the NBA: Towards an Algorithmic Taxonomy of Basketball Plays", MIT
Sports Conference
McQueen (2014), "Automatically Recognizing On-Ball Screens", MIT Sports Conference
Wiens (2013), "To Crash or Not To Crash: A Quantitative Look at the Relationship Between Offensive Rebounding and Transition Defense in the NBA", MIT Sports Conference

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