














BHI260AP

SELF-LEARNING AI SENSOR

BOSCH SENSORTEC

Smart sensors

Bosch Sensortec portfolio

Motion sensors	Environmental sensors	Smart sensors	Optical microsystems
 Absolute orientation sensor (BMX)	 Gas sensor (BME)	 Smart sensors (BNO/BMF)	 Smartglasses Light Drive (BML)
 Inertial measurement unit (BMI)	 Humidity sensor (BME)	 Smart sensors (BHI)	
 Accelerometer (BMA)	 Barometric pressure sensor (BMP)	 Smart sensors (BHA)	
 Gyroscope (BMG)			
 Magnetometer (BMM)			
 Software & tools, embedded algorithms and artificial intelligence (AI)			

Smart sensors

Product variants

	Product name	Sensor fusion (BSX3)	Sensor fusion (BSX4)	PDR1.0	PDR2.0	Swim	Self-learning AI
2nd Gen	BHI260AP (Pro)		✓		✓	✓	✓
	BHI260AB (Basis)		✓				
1st Gen	BHI160BP (PDR1)	✓		✓			
	BHI160B (Basis)	✓					

Self-learning AI sensor

Fitness user's pain points

Multiple activities



Limited time of coach



Manual tracking



Classical tracking systems fail: Variety of machines and body activities, home workouts, switching among activities, demographics and individual user energy levels

Self-learning AI sensor

Software solutions

System power



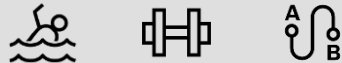
- ▶ In-sensor features
 - ▶ Step count
 - ▶ (Wrist)Wake-up
 - ▶ Multi-tap
 - ▶ Activity status
- ▶ PDR+GPS fusion



Unique features



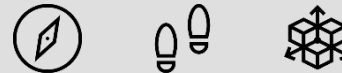
- ▶ Activity tracking
 - ▶ Automatic
 - ▶ Extensible
 - ▶ Personalized



Scalability



- ▶ Standalone modules of fusion
- ▶ Flexibility in product specific choices
 - ▶ Performance vs. power
 - ▶ Features vs. size



Data quality



- ▶ In-use calibration
- ▶ Distortion detection
- ▶ Multi-sensor fusion



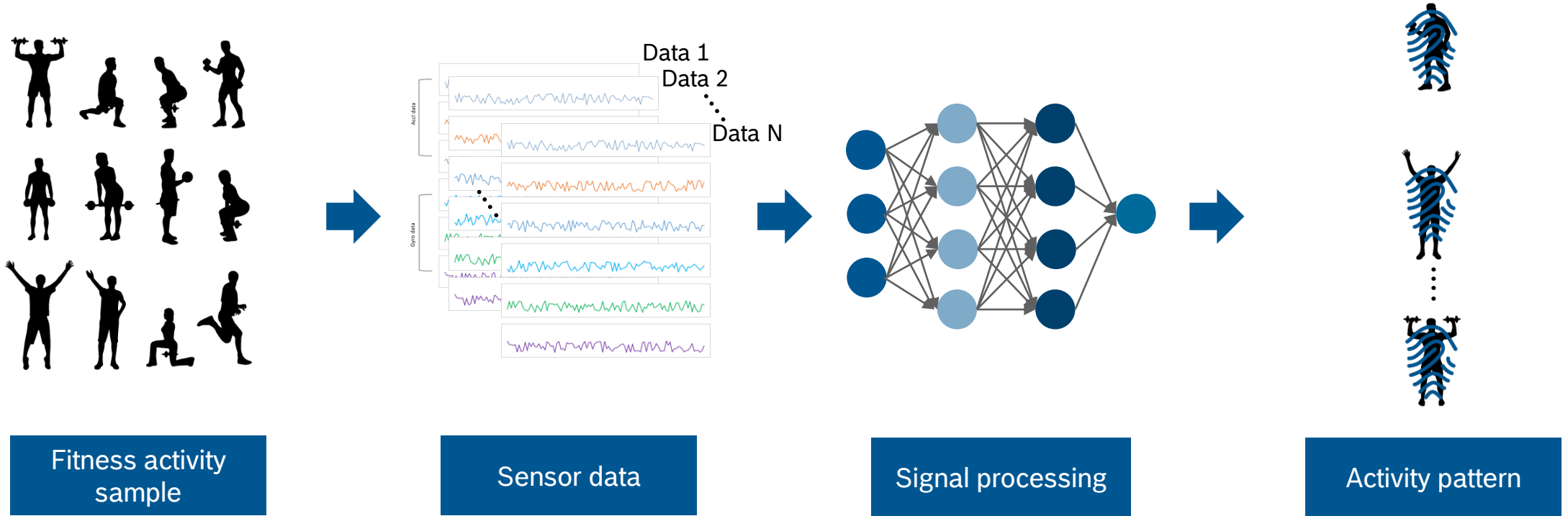
Self-learning AI sensor

Video



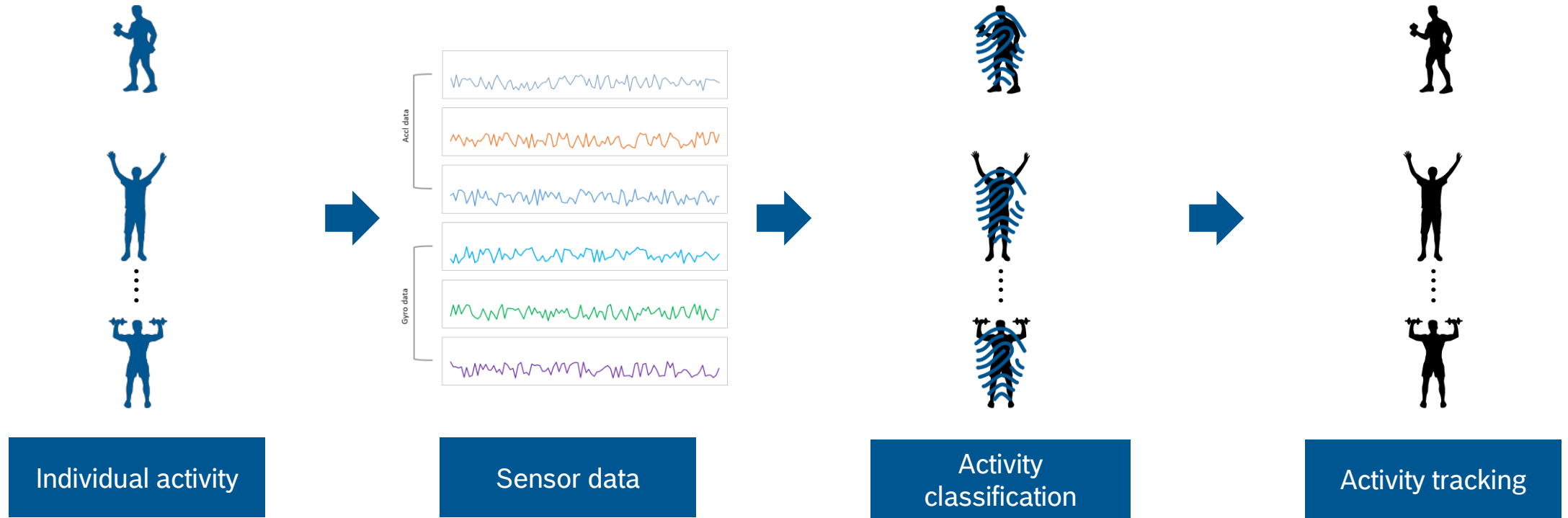
Self-learning AI sensor

Activity pattern learning



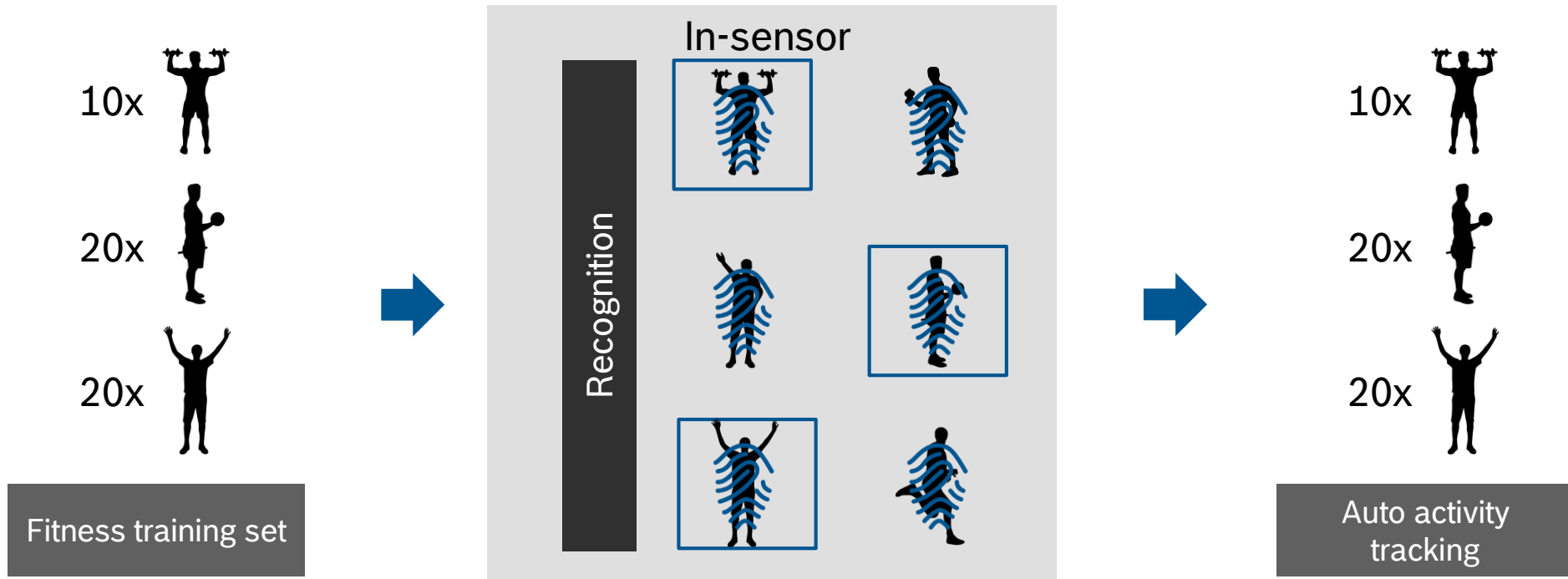
Self-learning AI sensor

Activity pattern recognition



Self-learning AI sensor

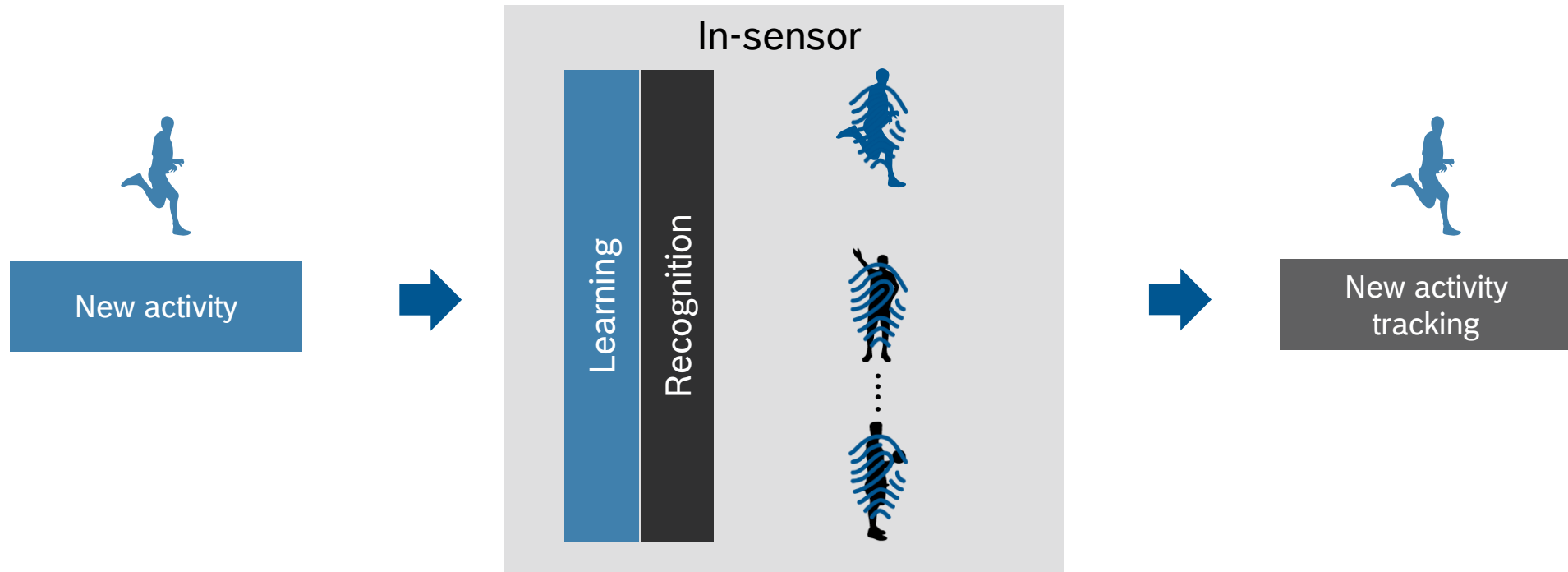
Product features – “Auto-track”



- ▶ Bosch Sensortec provides 10+ common patterns + learning & recognition built-in library based on sample data
- ▶ OEMs can customize / generate their own patterns directly using the sensor or offline
- ▶ OEMs can also enhance / add new patterns over the air without retraining the entire dataset

Self-learning AI sensor

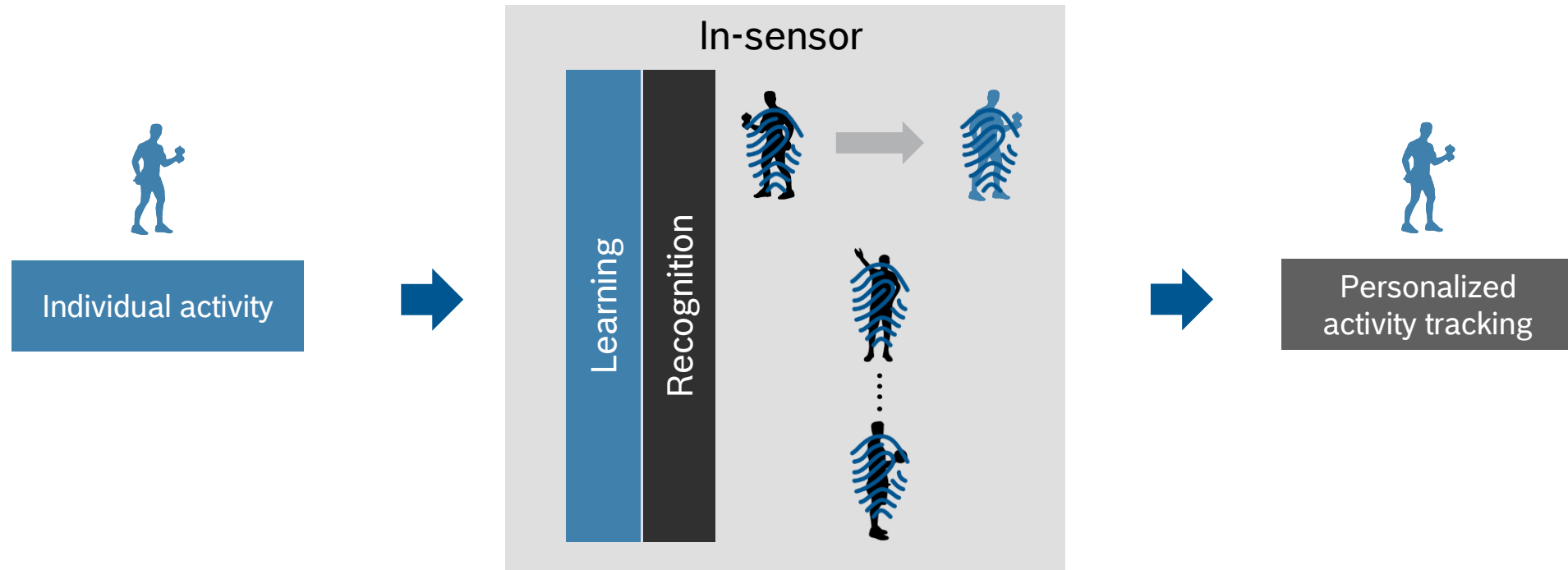
Product features – “Learn New” from user



- ▶ Adding new activities by users does not need any changes in software / effort for OEMs
- ▶ Learning and recognition can be enabled / disabled dynamically with sensor API

Self-learning AI sensor

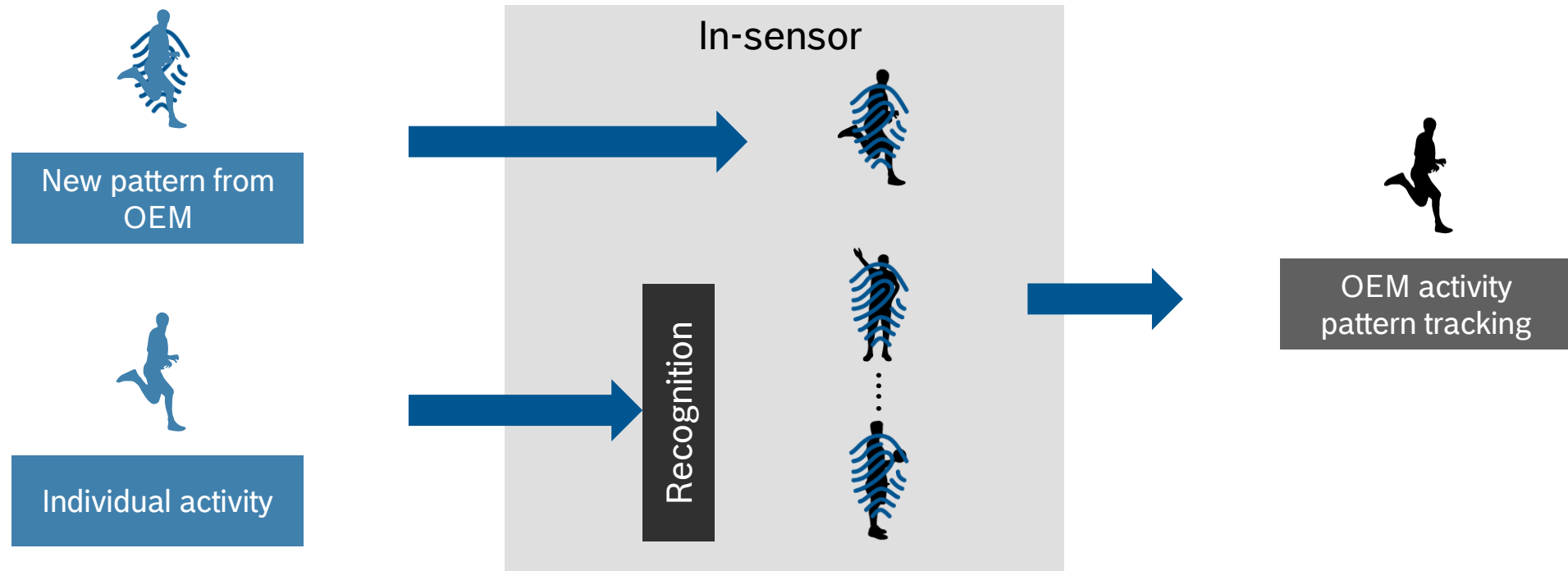
Product features – “Personalize”



- ▶ Users can personalize built-in activities to match their own style without changing the software
- ▶ Sensor API enables users to relearn & replace activities directly from the device
- ▶ Bosch Sensortec provides reference code / App to help enable personalization

Self-learning AI sensor

Product features – “Enhance”



- ▶ Bosch Sensortec provides 10+ common patterns + learning & recognition built-in library based on sample data
- ▶ OEMs can also enhance / add new patterns without modifying the software or needing the original dataset to enhance the device value

Self-learning AI sensor

Reference activities for self-learning and automatic tracking

#	Activity	Reference video
1	Bicep Curls Dumbbell	Link
2	Bicep Curls Dumbbell Palm Face Front	Link
3	Triceps Extensions Dumbbell	Link
4	Bench Press Dumbbell	Link
5	Crunches	Link
6	Side Lateral Raise Dumbbell	Link
7	Squats Bodyweight	Link
8	Jumping Jacks	Link
9	Kettlebell Swing	Link
10	Row Machine	Link
11	Lower Back	Link
12	Russian Twist	Link
13	Triceps Kickbacks	Link
14	Chest Fly Dumbbell	Link
15	Pull Over Dumbbell	Link

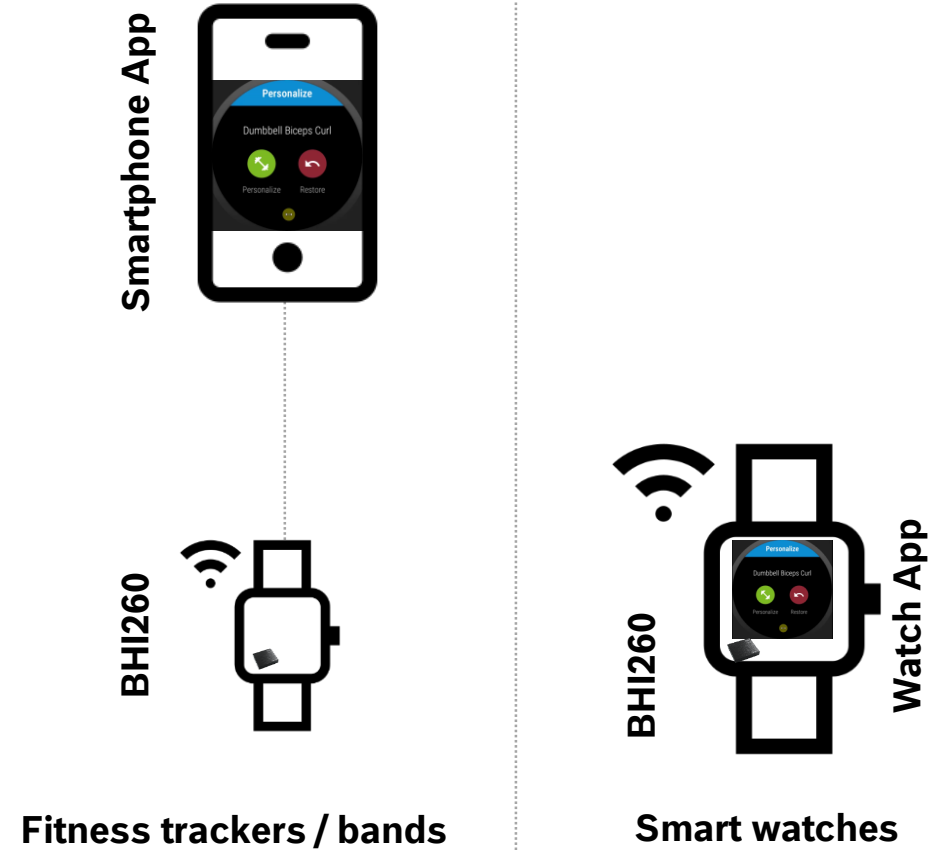
Self-learning AI sensor Evaluation system

Reference software

- ▶ Visualization via Android App
- ▶ BLE (AP): Streaming, load firmware

BHI260AP

- ▶ Learning of new exercises
- ▶ Personalization & recognition of pre-trained exercises



Self-learning AI sensor

Summary: Key facts

Key performance factors		Bosch Sensortec self-learning AI software
Functionality End-user experience	Learning (new activities)	Learning inside device → enables learning new activities from users
	Personalization of tracking	Learning inside device → enables full personalization to a user
	Tracking: number of activities	Large number of activities (typ. 10~50) tracked simultaneously
	Tracking: status / count	Both activity status and count for all activities
	In-field customization / enhancement	OEMs can also add new activities just by adding new patterns without changing the software
Design Time to market	Data labelling	No need of labelling individual activity signals. Patterns are generated based on larger datasets with a cloud based simulator
	ML / AI and statistics	No need of manual selection and implementation of statistical features
	Design time customization	OEMs can customize and configure both patterns and software with a cloud based simulator during design

Self-learning AI software delivers a *truly personalized experience* with state-of-the-art edge-AI