VibroBP: Calibrationless Smartphone BP Monitoring using Vibrometric Force Estimation

Health monitoring is just a download away. The VibroBP app is the first software only solution to measure blood pressure without need for individual user calibration.

According to the CDC, nearly half of the 1.28 billion adults with hypertension are unaware of hypertensive condition and not seeking treatment. Expanding access to health monitoring beyond traditional clinical settings is a first step towards diagnosing the nearly 500 million adults unaware of their hypertensive condition.
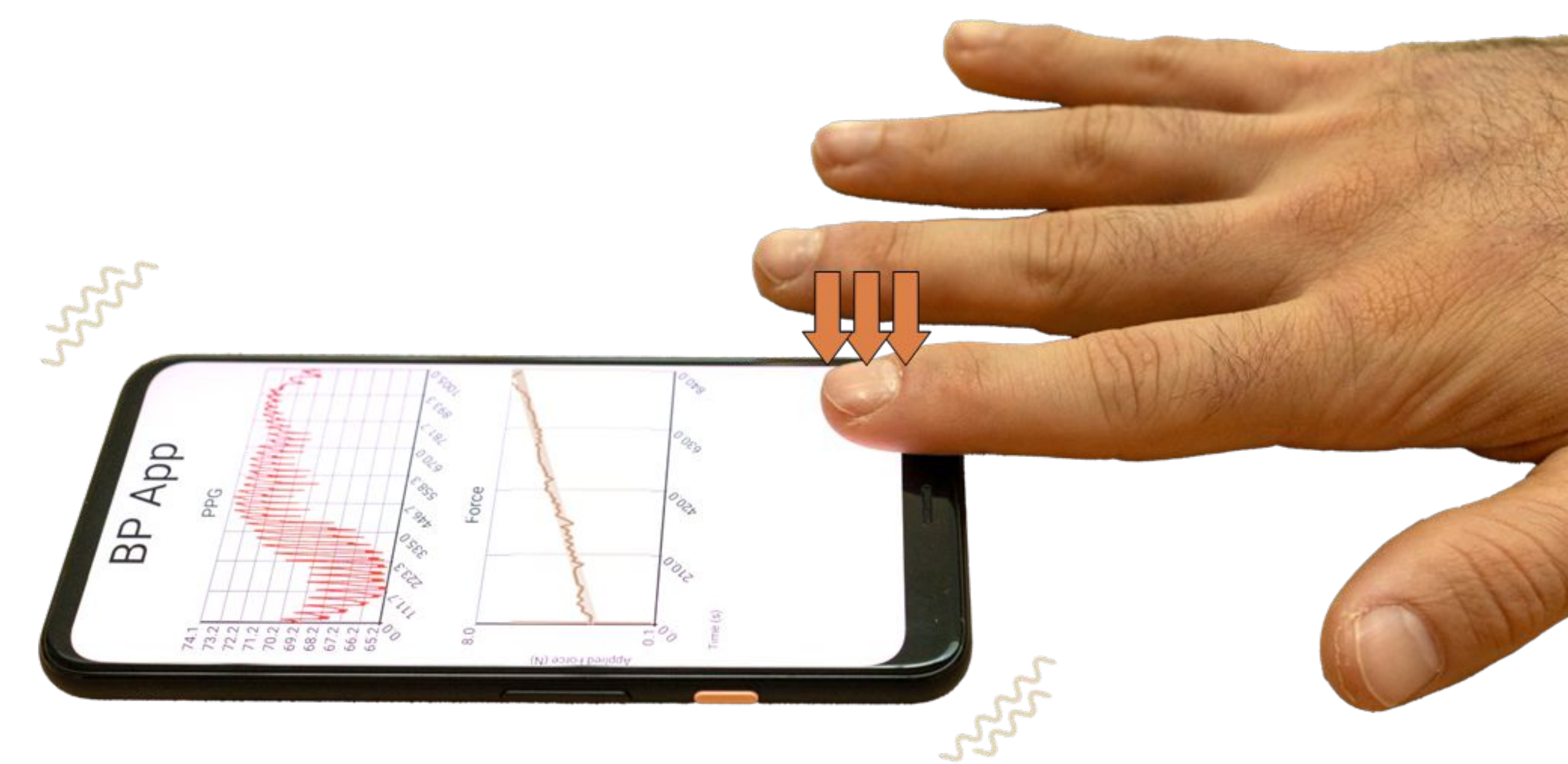

Figure 1: VibroBP App
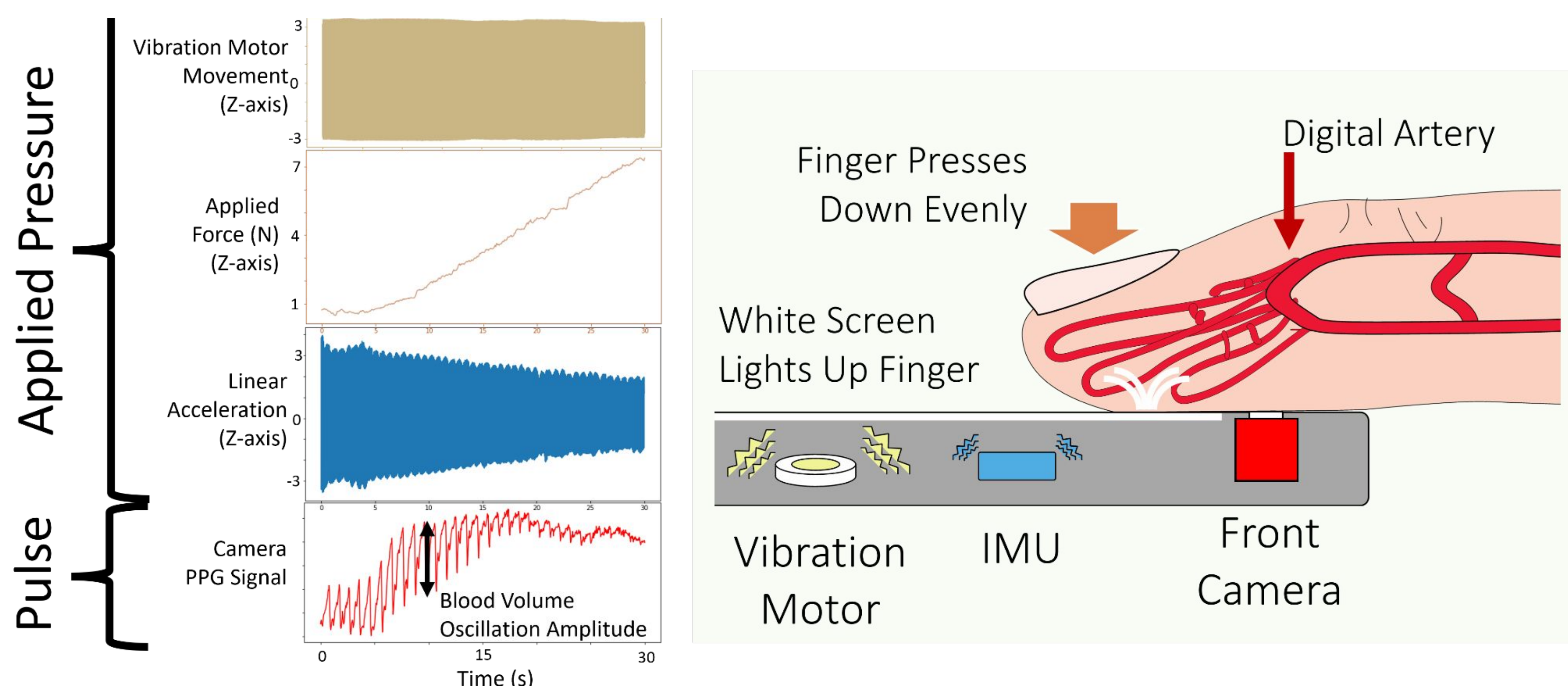
Concept Overview

Figure 2: Vibrometric Force Estimation.

The VibroBP measurement leverages the smartphone camera, vibration motor, inertial measurement unit, and display screen included in nearly every smartphone. By leveraging the natural effect of dampening as force is applied to a vibrating object, the app can measure the force applied by the finger as the user presses on the camera. A technique we call Vibrometric Force Estimation.

Vibrometric Force Estimation

The force measure achieved an average correlation coefficient of 0.92 across multiple smartphones of different cost, manufacturer, and physical shape.
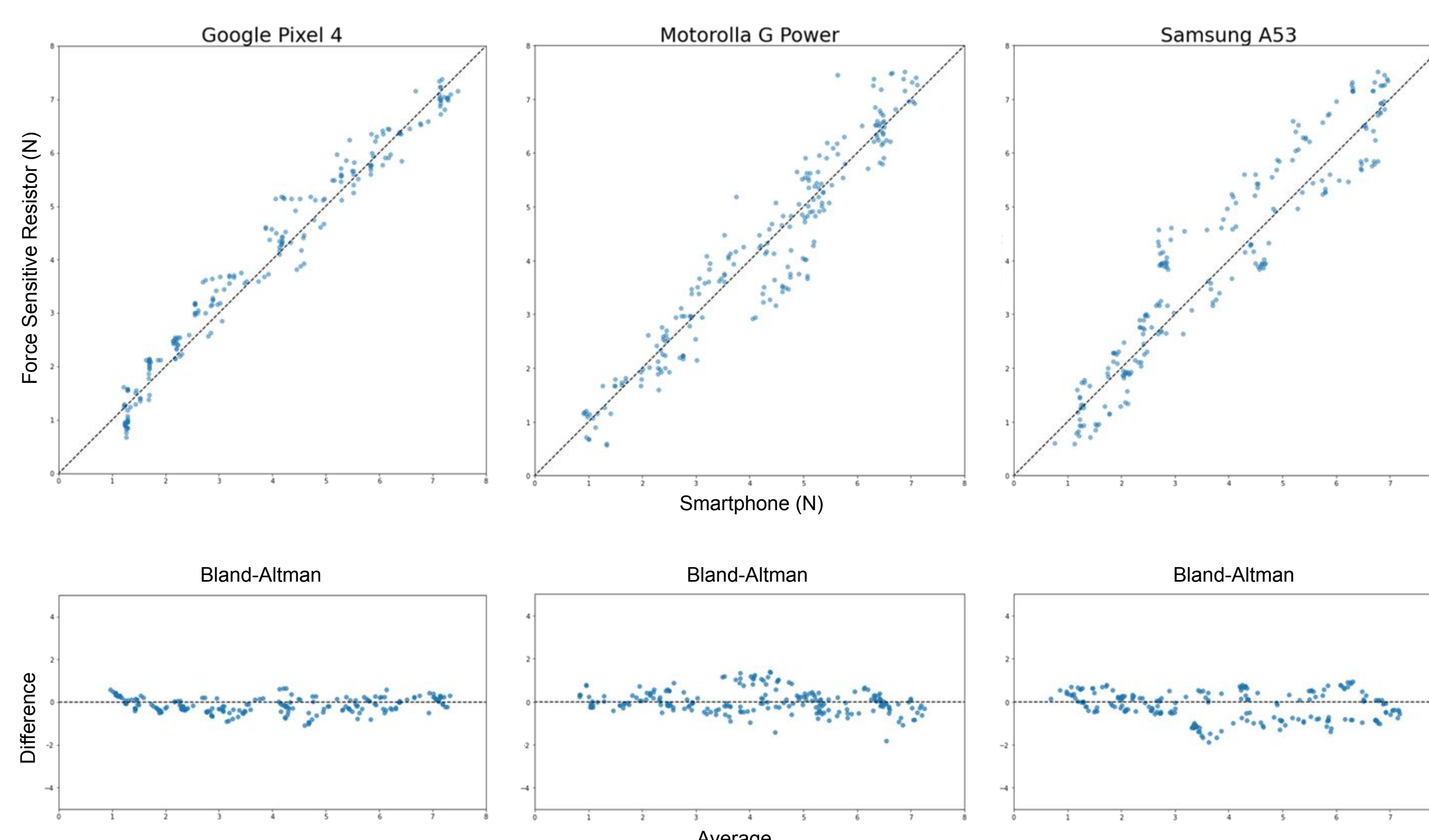

Figure 4: Force Estimation Performance on Difference Smartphone Devices

Proof of Concept

In an exercise induced hypertension study (N=24), the VibroBP App has close to FDA required performance of both SBP/DBP with no smartphone modifications or individual calibrations.

	Systolic 87-165 mmHg	Diastolic 54-119 mmHg	FDA Target
Mean (mmHg)	0.44	0.03	<5
Std (mmHg)	10.2	10.5	<8

Table 1: SBP/DBP Performance Against FDA Target

Oscillometric Blood Pressure

VibroBP, performs fingertip BP measurements using the same underlying methodology as upper-arm cuff devices. Two key metrics are required:
(1) the PRESSURE applied to the artery
(2) the PULSE AMPLITUDE of the artery.

Conceptually, the oscillogram captures the pressure required to cut off the pulse. Consequently, for a higher blood pressure, the peak of the oscillogram shifts right.
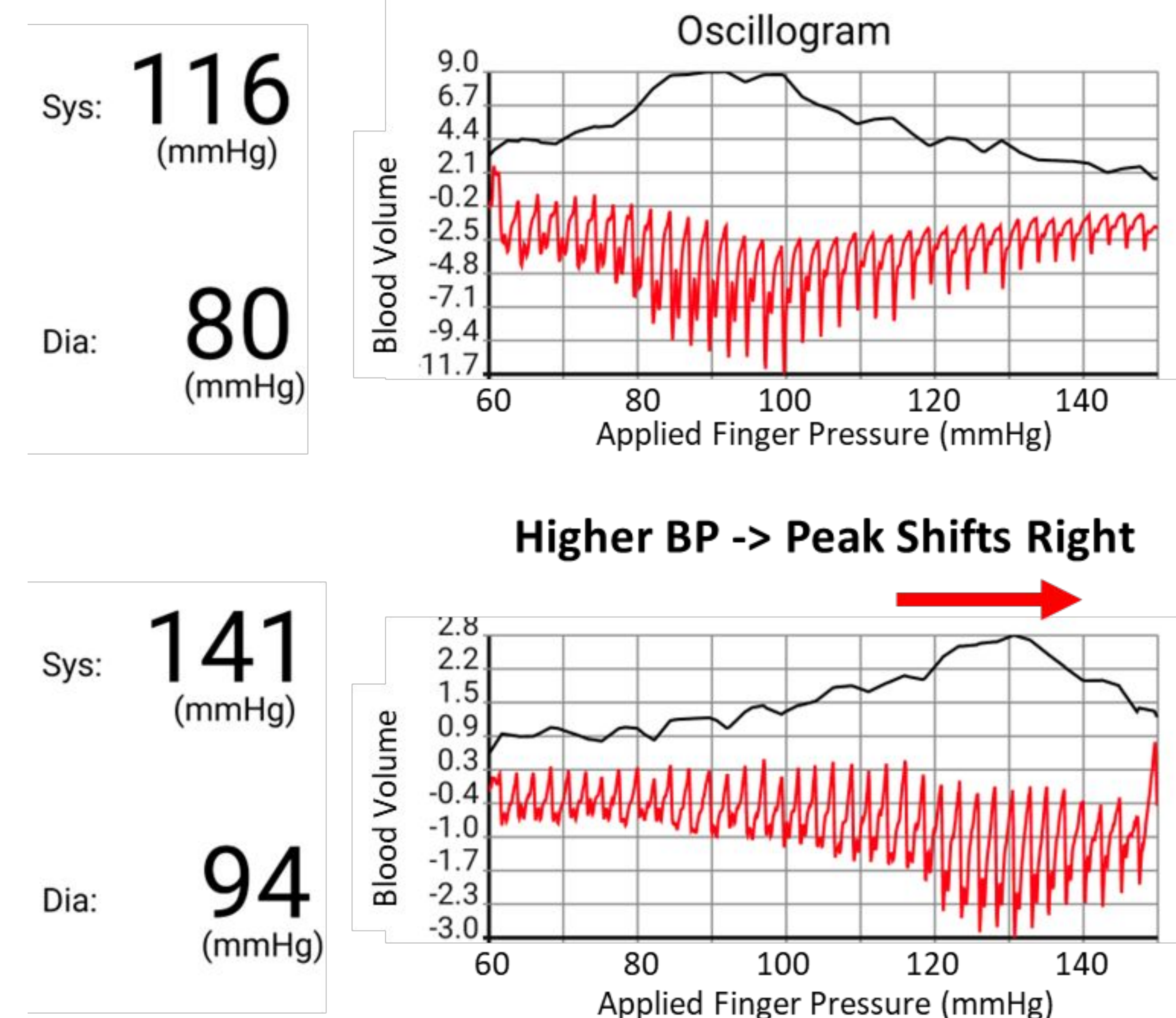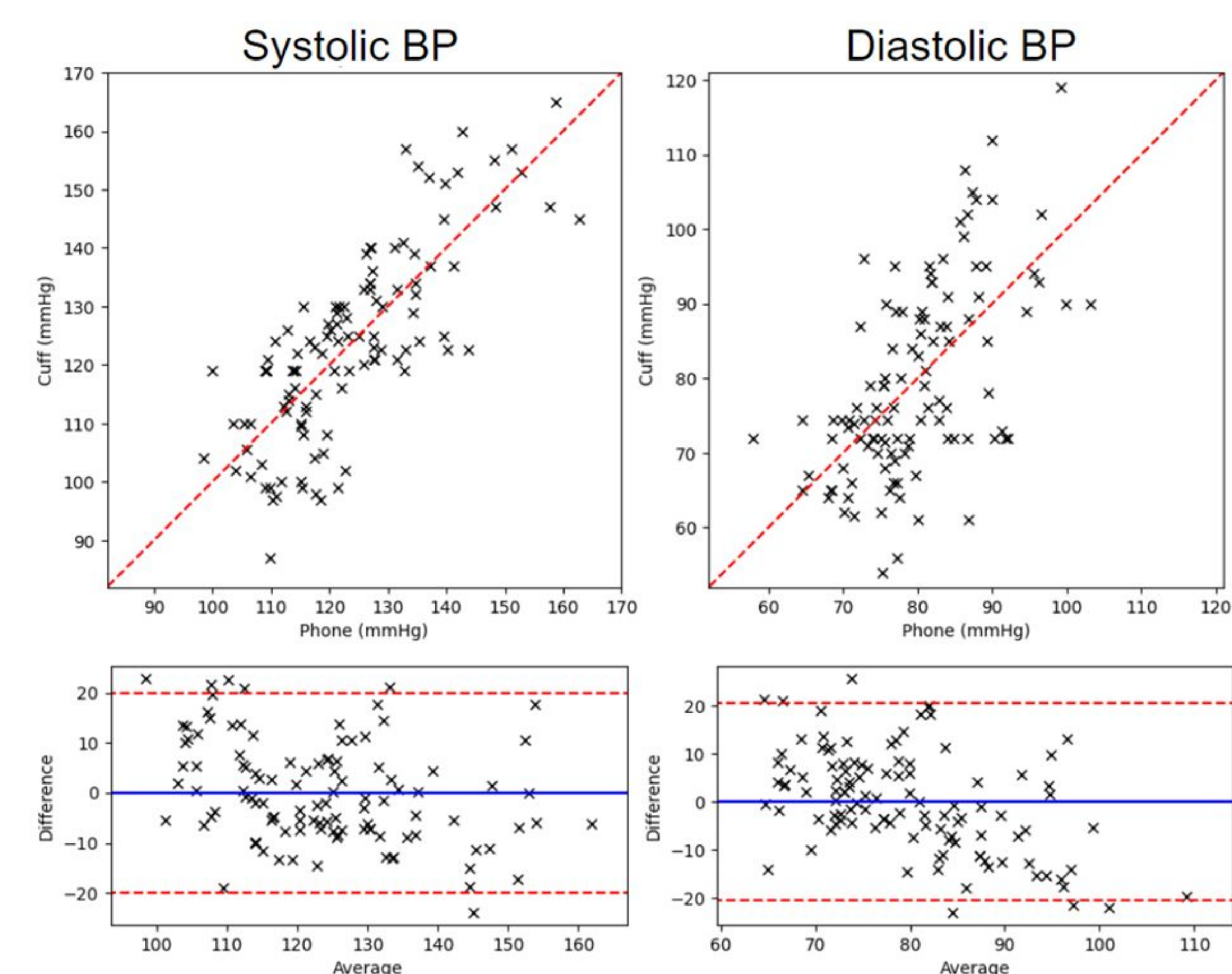

Figure 3: Oscillometric Blood Pressure Estimation

Figure 5: Feasibility Result for SBP/DBP

Colin Barry, Tatsuo Kumamoto, Yinan Xuan, Ava Fascetti, Amparo Averbuj, Edward J. Wang

BILLION LABS

Learn more about the lab

View the publication

UC San Diego — THE DESIGN LAB