Hot Shoes in the Room: Authentication of Thermal Imaging for Quantitative Forensic Analysis

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January 15, 2018

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Supplementary Material: Coefficients of Beta distributions describing pixel values at different intensity levels

Table 1: Shape parameters (v and ω) defining a beta distribution describing the probability of obtaining different pixel values (ρ) at various intensity levels for the Fuji shoe. Mean ρ value for each intensity level was calculated from the corresponding shape parameters [1].

$\begin{array}{c c} \rho = 40 & v = 4066.1(2832.7, 6363.0) & 43.99 \\ \rho = 45 & v = 791.4(662.9, 983.3) & 47.29 \\ \rho = 50 & v = 1385.8(1200.8, 1640.8) & 53.10 \\ \rho = 55 & v = 1541.9(1389.7, 1728.8) & 57.43 \\ \rho = 60 & v = 1547.2(1366.0, 1782.3) & 62.27 \\ \rho = 65 & v = 1538.0(1326.1, 1816.8) & 67.32 \\ \rho = 65 & v = 1578.8(3696.4, 5070.7) & 67.32 \\ \rho = 70 & v = 1776.7(1485.2, 2196.2) & 72.33 \\ \rho = 75 & v = 1964.4(1514.2, 2713.1) & 77.37 \\ \rho = 80 & v = 2957.4(2202.0, 4198.9) & 82.25 \\ \rho = 85 & v = 2407.0(1885.4, 3269.2) & 87.52 \\ \rho = 90 & v = 3839.8(2652.6, 7055.0) & 92.78 \\ \rho = 100 & v = 645.5(449.0, 1155.6) & 044.42 \\ \end{array}$	pixel intensity level ($ ho$)	Shape parameters	Mean
$\begin{split} \rho &= 45 & \nu = 791.4 (662.9, 983.3) & 47.29 \\ \rho &= 50 & \nu = 1385.8 (1200.8, 1640.8) \\ \rho &= 55 & \nu = 1541.9 (1389.7, 1728.8) & 57.43 \\ \rho &= 60 & \nu = 1547.2 (1366.0, 1782.3) & 62.27 \\ \rho &= 65 & \nu = 1538.0 (1326.1, 1816.8) & 67.32 \\ \rho &= 65 & \nu = 1776.7 (1485.2, 2196.2) & 72.33 \\ \rho &= 70 & \nu = 1964.4 (1514.2, 2713.1) & 77.37 \\ \rho &= 75 & \nu = 1964.4 (1514.2, 2713.1) & 77.37 \\ \rho &= 80 & \nu = 2957.4 (2202.0, 4198.9) & 82.25 \\ \rho &= 85 & \nu = 4207.0 (1885.4, 326.92) & 87.52 \\ \rho &= 90 & \nu = 3839.8 (2652.6, 7055.0) & 92.78 \\ \rho &= 90 & \nu = 3065.3 (2040.7, 5682.7) & 97.45 \\ \rho &= 100 & \nu = 930.8 (643.5, 1693.8) & 104.42 \\ \end{split}$	$\rho = 40$	v = 4066.1(2832.7, 6363.0) $\omega = 19506.2(13611.6, 30515.5)$	43.99
$\begin{split} \rho &= 50 & v = 1385.8(1200.8,1640.8) & 53.10 \\ \rho &= 55 & v = 1541.9(1389.7,1728.8) & 57.43 \\ \rho &= 60 & v = 1547.2(1366.0,1782.3) & 62.27 \\ \rho &= 65 & v = 1538.0(1326.1,1816.8) & 67.32 \\ \rho &= 65 & v = 1538.0(1326.1,1816.8) & 67.32 \\ \rho &= 70 & v = 1776.7(1485.2,2196.2) & 72.33 \\ \rho &= 75 & v = 1964.4(1514.2,2713.1) & 77.37 \\ \rho &= 75 & v = 2957.4(2202.0,4198.9) & 82.25 \\ \rho &= 80 & v = 2407.0(1885.4,3269.2) & 87.52 \\ \rho &= 85 & v = 3839.8(2652.6,7055.0) & 92.78 \\ \rho &= 90 & w = 6714.2(4650.1,12261.4) & 92.78 \\ \rho &= 100 & w = 930.8(643.5,1693.8) & 104.42 \\ \end{split}$	ho = 45	v = 791.4(662.9, 983.3) w = 3476.2(2904.2, 4331.2)	47.29
$\begin{split} \rho &= 55 & \psi = 1541.9(1389.7, 1728.8) \\ \omega &= 5304.8(4778.9, 5948.9) & \psi = 1547.2(1366.0, 1782.3) \\ \omega &= 4789.2(4225.1, 5520.8) & \psi = 1538.0(1326.1, 1816.8) \\ \omega &= 4287.8(3696.4, 5070.7) & \phi = 70 & \psi = 1776.7(1485.2, 2196.2) \\ \rho &= 70 & \psi = 1776.7(1485.2, 2196.2) & 72.33 \\ \rho &= 75 & \psi = 1964.4(1514.2, 2713.1) & 77.37 \\ \rho &= 80 & \psi = 2957.4(2202.0, 4198.9) & 82.25 \\ \rho &= 85 & \psi = 2407.0(1885.4, 3269.2) & \psi = 3839.8(2652.6, 7055.0) & \psi = 3839.8(2652.6, 7055.0) & \psi = 3065.3(2040.7, 5682.7) & \phi = 4955.6(3292.9, 9247.6) & \psi = 30.8(643.5, 1693.8) & 104.42 \\ \rho &= 100 & \psi = 930.8(643.5, 1693.8) & 104.42 \\ \end{split}$	ho = 50	w = 5176.2(2501.2, 1351.2) v = 1385.8(1200.8, 1640.8) w = 5269.2(4576.0, 6229.6)	53.10
$\rho = 60 \qquad $	ho = 55	w = 5205.2(4370.6, 5225.6) v = 1541.9(1389.7, 1728.8) w = 5304.8(4778.9, 5948.9)	57.43
$ \begin{aligned} \rho &= 65 & v = 1538.0 (1326.1, 1816.8) \\ \omega &= 4287.8 (3696.4, 5070.7) \\ \rho &= 70 & v = 1776.7 (1485.2, 2196.2) \\ \omega &= 4486.8 (3751.8, 5551.7) \\ \rho &= 75 & v = 1964.4 (1514.2, 2713.1) \\ \omega &= 4509.9 (3468.1, 6233.8) \\ \rho &= 80 & v = 2957.4 (2202.0, 4198.9) \\ \omega &= 6211.9 (4623.7, 8816.6) \\ \rho &= 85 & v = 2407.0 (1885.4, 3269.2) \\ \omega &= 4606.4 (3603.3, 6265.3) \\ \rho &= 90 & v = 3839.8 (2652.6, 7055.0) \\ \omega &= 6714.2 (4650.1, 12261.4) \\ \rho &= 95 & w = 4955.6 (3292.9, 9247.6) \\ \rho &= 100 & v = 930.8 (643.5, 1693.8) \end{aligned} $	ho = 60	w = 3504.0 (4776.9, 5546.9) v = 1547.2 (1366.0, 1782.3) w = 4789.2 (4225.1, 5520.8)	62.27
$\rho = 70$ $\nu = 1776.7 (1485.2, 2196.2)$ $\omega = 4486.8 (3751.8, 5551.7)$ $\rho = 75$ $\nu = 1964.4 (1514.2, 2713.1)$ $\omega = 4509.9 (3468.1, 6233.8)$ $\rho = 80$ $\nu = 2957.4 (2202.0, 4198.9)$ $\omega = 6211.9 (4623.7, 8816.6)$ $\nu = 2407.0 (1885.4, 3269.2)$ $\omega = 4606.4 (3603.3, 6265.3)$ $\rho = 90$ $\omega = 6714.2 (4650.1, 12261.4)$ $\rho = 95$ $\omega = 4955.6 (3292.9, 9247.6)$ $\rho = 100$ $\omega = 930.8 (643.5, 1693.8)$ 104.42	ho = 65	w = 4787.8(326.1, 1816.8) w = 4287.8(3696.4, 5070.7)	67.32
$\rho = 75$ $\rho = 80$ $\rho = 85$ $\rho = 90$ $\rho = 95$ $\rho = 100$ $\omega = 4430.8(3751.8, 3531.7)$ $v = 1964.4(1514.2, 2713.1)$ $\omega = 4509.9(3468.1, 6233.8)$ $v = 2957.4(2202.0, 4198.9)$ $\omega = 6211.9(4623.7, 8816.6)$ $v = 2407.0(1885.4, 3269.2)$ $\omega = 4606.4(3603.3, 6265.3)$ $v = 3839.8(2652.6, 7055.0)$ $\omega = 6714.2(4650.1, 12261.4)$ $v = 3065.3(2040.7, 5682.7)$ $\omega = 4955.6(3292.9, 9247.6)$ $v = 645.5(449.0, 1155.6)$ $\omega = 930.8(643.5, 1693.8)$ 104.42	ho=70	w = 4207.8(3090.4, 3070.7) v = 1776.7(1485.2, 2196.2) w = 4486.8(3751.8, 5551.7)	72.33
$\rho = 80$ $\rho = 80$ $\nu = 2957.4(2202.0, 4198.9)$ $\omega = 6211.9(4623.7, 8816.6)$ $\nu = 2407.0(1885.4, 3269.2)$ $\omega = 4606.4(3603.3, 6265.3)$ $\rho = 90$ $\nu = 3839.8(2652.6, 7055.0)$ $\omega = 6714.2(4650.1, 12261.4)$ $\rho = 95$ $\omega = 4955.6(3292.9, 9247.6)$ $\rho = 100$ $\omega = 930.8(643.5, 1693.8)$ 104.42	ho = 75	w = 4400.8(3751.6, 5551.7) v = 1964.4(1514.2, 2713.1) w = 4509.9(3468.1, 6233.8)	77.37
$\rho = 85 \qquad $	ho = 80	w = 4309.9(3408.1, 0235.8) v = 2957.4(2202.0, 4198.9) w = 6211.9(4623.7, 8816.6)	82.25
$\rho = 90 \qquad $	ho = 85	w = 6211.9(4623.7, 8816.6) $v = 2407.0(1885.4, 3269.2)$ $w = 4606.4(2603.2, 6265.3)$	87.52
$\rho = 95 \qquad $	$\rho = 90$	w = 4606.4(3603.3, 6263.3) v = 3839.8(2652.6, 7055.0) w = 6714.2(4650.1, 12261.4)	92.78
	$\rho = 95$	$\omega = 6714.2 (4650.1, 12261.4)$ v = 3065.3 (2040.7, 5682.7)	97.45
	$\rho = 100$	$\omega = 4955.6 (3292.9, 9247.6)$ v = 645.5 (449.0, 1155.6) $\omega = 930 \ 8(643 \ 5, 1693 \ 8)$	104.42

Table 2: Shape parameters (v and ω) defining a beta distribution describing the probability of obtaining
different pixel values (ρ) at various intensity levels for the leather shoe. Mean ρ value for each intensity level
was calculated from the corresponding shape parameters [1].

pixel intensity level (ρ)	Shape parameters	Mean
$\rho = 40$	v = 2812.1 (1955.0, 4814.3)	43.74
ho = 45	w = 13382.7 (9401.0, 23103.3) $v = 875.3 (748.8, 1059.0)$ $w = 3791.7 (3254.0, 4566.3)$	47.82
ho = 50	$w = 37517 (32513, 1500.0)$ $v = 1110.8 (1005.7, 1233.8)$ $\omega = 4269.0 (3867.1, 4739.0)$	52.65
$\rho = 55$	v = 1352.6 (1213.4, 1522.9) $\omega = 4657.1 (4179.6, 5240.6)$	57.39
$\rho = 60$	v = 1597.9(1403.7, 1849.2) $\omega = 4960.0(4352.2, 5751.3)$	62.13
$\rho = 65$	v = 1587.0 (1365.8, 1885.2) $\omega = 4435.3 (3816.5, 5278.7)$	67.20
ho=70	v = 1934.4(1561.8, 2495.1) $\omega = 4869.6(3932.5, 6280.7)$	72.50
ho = 75	v = 2385.0 (1760.2, 3506.2) $\omega = 5477.5 (4041.3, 8057.1)$	77.35
ho = 80	v = 1893.5(1400.1, 2928.1) $\omega = 3972.0(2927.4, 6167.4)$	82.31
$\rho = 85$	v = 3120.0 (2088.5, 5816.1) $\omega = 6015.6 (4010.7, 11267.3)$	87.09
$\rho = 90$	v = 511.6(272.1, 2554.5) $\omega = 876.9(452.8, 4481.2)$	93.95

Table 3: Shape parameters (v and ω) defining a beta distribution describing the probability of obtaining
different pixel values (ρ) at various intensity levels for the Cumulus shoe. Mean ρ value for each intensity
level was calculated from the corresponding shape parameters [1].

pixel intensity level (ρ)	Shape parameters	Mean
$\rho = 40$	v = 8536.1(5341.3, 33648.6)	44.36
	$\omega = 40537.0 (25409.3, 158498.2)$	
$\rho = 45$	v = 836.0(726.0, 972.5)	47.44
P	$\omega = 3657.7 (3177.8, 4254.6)$	
$\rho = 50$	v = 1312.9(1184.0, 1473.8)	52.88
P 00	$\omega = 5018.3 (4523.6, 5623.5)$	02.00
a = 55	v = 1261.5(1137.4, 1419.1)	57 04
p cc	$\omega = 4377.9 (3942.4, 4931.5)$	0,101
ho = 60	v = 1464.3(1256.6, 1735.2)	62.41
	$\omega = 4519.0(3874.7, 5359.7)$	
a = 65	v = 1560.4(1298.0, 1946.8)	67 41
p 00	$\omega = 4342.6 (3605.6, 5429.8)$	07.11
$\rho = 70$	v = 2100.2 (1671.7, 2769.2)	72.21
p	$\omega = 5316.5 (4232.7, 7029.1)$	
a = 75	v = 1710.4(1394.4, 2208.1)	77.26
p 70	$\omega = 3935.0 (3205.9, 5085.2)$	
a = 80	v = 2784.0(2088.9, 3937.4)	82.39
P = 00	$\omega = 5832.2 (4377.2, 8271.2)$	
ho = 85	v = 2740.3 (1986.5, 4190.9)	87.53
	$\omega = 5243.0(3801.5, 8023.6)$	
ho = 90	v = 3116.1(2226.3, 4951.0)	92.51
	$\omega = 5473.5(3907.9, 8739.4)$	
$\rho = 95$	v = 3069.2(2245.5, 4856.6)	97.32
	$\omega = 4972.6(3640.1, 7858.0)$	
<i>ρ</i> = 100	v = 791.5(487.3, 1810.7)	103.79
	$\omega = 1153.1 (703.9, 2683.6)$	

References

1. Gaussorgues, G. Infrared Thermography; Chapman & Hall: London, UK, 1994.