#### 24 Result Class Variables

Variables and their definitions for the 3 results classes are presented here. Detailed mathematical explanations and associated equations are available in the Methods Manuscript.

# 24.1 VCG Morphology Class (VCG\_Morphology.m)

Variable	Description	Units
TCRT	Total Cosine R to T (range 0 - 1)	_
TCRT_angle	$Angle \ from \ TCRT = acos(TCRT)$	$\deg$
qrsloop_residual	SVD variance from fitting QRS loop to a plane $(0 = \text{perfect fit}) = \text{qrs\_S3}^2$	_
qrsloop_rmse	RMSE for fit of QRS loop to best fit plane (0 = perfect fit)	mV
qrsloop_roundness	QRS loop roundness. 1 = perfect circle, larger values are increasingly elliptical = qrs_S1/qrs_S2	_
qrsloop_area	Area of QRS loop	mV
qrsloop_perimeter	Length of QRS loop projected into best fit plane	$\mathrm{mV}^2$
tloop_residual	SVD variance from fitting T loop to a plane (0 = perfect fit) = $t$ 53 <sup>2</sup>	_
tloop_rmse	RMSE for fit of T loop to best fit plane $(0 = perfect fit)$	mV
tloop_roundness	T loop roundness. $1 = \text{perfect circle}$ , larger values are increasingly elliptical = $t_S1/t_S2$	_
tloop_area	Area of T loop	mV
${\sf tloop\_perimeter}$	Length of T loop projected into best fit plane	$\mathrm{mV}^2$
qrs_loop_normal	Unit vector normal to best fit QRS loop plane	_
t_loop_normal	Unit vector normal to best fit T loop plane	
qrst_dihedral_ang	Dihedral angle between best fit QRS loop and T loop planes	$\deg$
qrs_S1	1st singular value of QRS loop	
qrs_S2	2nd singular value of QRS loop	_
qrs_S3	3rd singular value of QRS loop	
t_S1	1st singular value of T loop	_
t_S2	2nd singular value of T loop	_
t_\$3	3rd singular value of T loop	-
qrs_var_s1_total	% of total variance made up by 1st QRS singular value	%
qrs_var_s2_total	% of total variance made up by 2nd QRS singular value	%
qrs_var_s3_total	% of total variance made up by 3rd QRS singular value	%
t_var_s1_total	% of total variance made up by 1st T singular value	%
t_var_s2_total	% of total variance made up by 2nd T singular value	%
t_var_s3_total	% of total variance made up by 3rd T singular value	%
TMD	T wave mechanical dispersion	deg
TWR_abs	Absolute T wave residuum	$\mathrm{mV^2}$
TWR_rel	Relative T wave residuum	%

# 24.2 VCG Calculation Class (VCG\_Calc.m)

Variable	Description	$\mathbf{Units}$
qrs_int	QRS duration	ms
qt_int	QT interval	ms
svg_x	$X \ { m component} \ { m of} \ { m SVG} = { m XQ\_area} + { m XT\_area}$	mV·ms
svg_y	Y component of $SVG = YQ\_area + YT\_area$	$\mathrm{mV}{\cdot}\mathrm{ms}$
svg_z	$ m Z\ component\ of\ SVG = ZQ\_area + ZT\_area$	$mV \cdot ms$
sai_x	Area under absolute value of the median X QRST complex	$mV \cdot ms$
sai_y	Area under absolute value of the median Y QRST complex	$\mathrm{mV}{\cdot}\mathrm{ms}$
sai_z	Area under absolute value of the median Z QRST complex	$mV \cdot ms$
sai_qrst	$SAI QRST = sai_x + sai_y + sai_z$	mV⋅ms
sai_vm	Area under median VM QRST complex (always positive)	mV·ms
q_peak_mag	Magnitude of peak QRS vector	mV
q_peak_az	Azimuth of peak QRS vector	deg
q_peak_el	Elevation of peak QRS vector	$\deg$
t_peak_mag	Magnitude of peak T wave vector	$\mathrm{mV}$
t_peak_az	Azimuth of peak T wave vector	deg
t_peak_el	Elevation of peak T wave vector	deg
svg_peak_mag	Magnitude of the sum of peak QRS and peak T vectors ("peak SVG")	$\mathrm{mV}$
svg_peak_az	Azimuth of the "peak SVG" vector	deg
svg_peak_el	Elevation of the "peak SVG" vector	deg
q_area_mag	Magnitude of QRS area vector ([XQ_area, YQ_area, ZQ_area])	$\mathrm{mV}{\cdot}\mathrm{ms}$
q_area_az	Azimuth of QRS area vector	deg
q_area_el	Elevation of QRS area vector	$\deg$
t_area_mag	Magnitude of T-wave area vector [XT_area, YT_area, ZT_area]	$\mathrm{mV}{\cdot}\mathrm{ms}$
t_area_az	Azimuth of T-wave area vector	$\deg$
t_area_el	Elevation of T-wave area vector	$\deg$
svg_area_mag	Magnitude of the SVG vector [svg_x, svg_z, svg_z]	mV⋅ms
svg_area_az	Azimuth of the SVG vector	deg
svg_area_el	Elevation of the SVG vector	deg
qrst_angle_area	Area (mean) QRST angle: 3D angle between area QRS and area T wave vectors	deg
qrst_angle_peak	Peak QRST angle: 3D angle between peak QRS and peak T wave vectors	$\deg$
qrst_angle_peak_frontal	Projection of area QRST angle into frontal plane	deg
qrst_angle_area_frontal	Projection of peak QRST angle into frontal plane	deg
XQ_area	Area under median X QRS complex	mV⋅ms
YQ_area	Area under median Y QRS complex	$\mathrm{mV}{\cdot}\mathrm{ms}$
ZQ_area	Area under median Z QRS complex	$\mathrm{mV}{\cdot}\mathrm{ms}$
XT_area	Area under median X T wave	$mV \cdot ms$
YT_area	Area under median Y T wave	$\mathrm{mV}{\cdot}\mathrm{ms}$
ZT_area	Area under median Z T wave	$mV \cdot ms$
VMQ_area	Area under median VM QRS complex	$mV \cdot ms$
VMT_area	Area under median VM T wave	$mV \cdot ms$

Variable	Description	Units
XQ_peak	Value of median X QRS complex at time of maximum distance from origin	mV
YQ_peak	Value of median Y QRS complex at time of maximum distance from origin	$\mathrm{mV}$
ZQ_peak	Value of median Z QRS complex at time of maximum distance from origin	mV
XT_peak	Value of median X T wave at time of maximum distance from origin	mV
YT_peak	Value of median Y T wave at time of maximum distance from origin	$\mathrm{mV}$
ZT_peak	Value of median Z T wave at time of maximum distance from origin	mV
speed_max	Maximum speed across the entire VCG loop	$\mathrm{mV/ms}$
speed_min	Minimum speed across the entire VCG loop	$\mathrm{mV}/\mathrm{ms}$
speed_med	Median speed across the entire VCG loop	$\mathrm{mV}/\mathrm{ms}$
time_speed_max	Time after QRS onset of maximum VCG speed	ms
time_speed_min	Time after QRS onset of minimum VCG speed	ms
speed_qrs_max	Maximum speed across the QRS VCG loop	$\mathrm{mV}/\mathrm{ms}$
speed_qrs_min	Minimum speed across the QRS VCG loop	$\mathrm{mV}/\mathrm{ms}$
speed_qrs_med	Median speed across the QRS VCG loop	$\mathrm{mV}/\mathrm{ms}$
time_speed_qrs_max	Time after QRS onset of maximum QRS speed	ms
time_speed_qrs_min	Time after QRS onset of minimum QRS speed	ms
speed_t_max	Maximum speed across the T wave loop	$\mathrm{mV}/\mathrm{ms}$
speed_t_min	Minimum speed across the T wave loop	$\mathrm{mV}/\mathrm{ms}$
$speed_t_med$	Median speed across the T wave loop	$\mathrm{mV}/\mathrm{ms}$
time_speed_t_max	Time after QRS onset of maximum T-wave speed	ms
time_speed_t_min	Time after QRS onset of minimum T-wave speed	ms
sti_qrst	Speed-time integral for QRST complex	mV
sti_qrs	Speed-time integral for QRS complex	mV
sti_t	Speed-time integral for T Wave	mV
qrst_distance_area	Distance between the area QRS and area T vectors	mV
qrst_distance_peak	Distance between the area QRS and area T vectors	mV
vcg_length_qrs	Length of QRS VCG loop	mV
vcg_length_t	Length of T wave VCG loop	mV
vcg_length_qrst	${\tt Length\ of\ QRST\ VCG\ loop} = {\tt vcg\_length\_qrs} + {\tt vcg\_length\_t}$	mV
vm_tpeak_time	Time after QRS onset of peak of median VM Twave	ms
vm_tpeak_tend_abs_diff	Time difference between T wave peak and T wave end in median VM lead	ms
<pre>vm_tpeak_tend_ratio</pre>	Ratio between time of T wave peak and time of T wave end in median VM lead	_

### 24.3 Lead Morphology Class (Lead\_Morphology.m)

[lead] refers to any of the 16 leads (L1, L2, L3, avR, avL, avF, V1-V6, X, Y, Z, VM)

<b>V</b> ariable	Description	Units
[lead]_r_wave	Magnitude of R wave on median beat of [lead]	mV
[lead]_s_wave	Magnitude of S wave on median beat of [lead]	mV
[lead]_rs_wave	$\label{eq:magnitude} \mbox{Magnitude of entire QRS complex} = \mbox{[lead]\_r\_wave} + \mbox{abs([lead]\_s\_wave}$	mV
[lead]_rs_ratio	Ratio of R wave to magnitude of entire QRS complex = [lead]_r_wave / [lead]_rs_wave	_
[lead]_sr_ratio	Ratio of S wave to magnitude of entire QRS complex = $[lead]_s\_wave / [lead]\_rs\_wave$	_
[lead]_t_max	Maximum magnitude of T wave in [lead]	mV
[lead]_t_max_loc	Timing of T wave maximum (after QRS onset) in [lead]	ms
[lead]_qrs_area	Area of [lead] median beat QRS complex	$mV \cdot ms$
[lead]_t_area	Area of [lead] median beat T wave	$\mathrm{mV}{\cdot}\mathrm{ms}$
[lead]_qrst_area	Area of [lead] median beat full QRST complex	$\mathrm{mV}{\cdot}\mathrm{ms}$
VM_max_rpk_loc	Timing of the maximum R wave in lead VM (maximum distance from origin)	ms
cornell_lvh_mv	$Cornell\ LVH = V3\_s\_wave\ +\ avL\_r\_wave$	mV
sokolow_lvh_mv	Sokolow-Lyon LVH = $V1_s_wave + max(V5_r_wave, V6_r_wave)$	mV
qrs_frontal_axis	Fontal plane QRS axis	deg

# 24.4 Other Variables

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SDNNStandard deviation of RR intervals only for beats included in median beatmsSDRRStandard deviation of RR intervals regardless of if they were removedmsRMSSD_nRoot mean square of successive differences only for beats included in median beatms	RR_pct	Percent change in subsequent RR intervals regardless of if they were removed	%
SDRR Standard deviation of RR intervals regardless of if they were removed ms RMSSD_n Root mean square of successive differences only for beats included in median beat ms	RR_sd	Successive differences in RR intervals regardless of if they were removed	ms
RMSSD_n Root mean square of successive differences only for beats included in median beat ms	SDNN	Standard deviation of RR intervals only for beats included in median beat	ms
	SDRR	Standard deviation of RR intervals regardless of if they were removed	ms
RMSSD_all Root mean square of successive differences regardless of if they were removed ms	RMSSD_n	Root mean square of successive differences only for beats included in median beat	ms
	RMSSD_all	Root mean square of successive differences regardless of if they were removed	ms