## 一、Mdwvdb数据库说明：

Mdwvdb（Median wave database）来自于Muse数据库的Median 波形，数据包括250Hz和500Hz两种采样率。该数据库主要用于验证波形特征点（PQRST）的识别准确性和Axis算法的验证。

数据包括8个通道的Meadian波形数据，和对应的P Onset， P Offset，QRS Onset，QRS Offset，TOffset的位置，以及QT间期、QRS宽度、PR间期的测量参考值。还包括心电轴等数据。

MUSE数据原来有2000组，大部分数据采样率为500Hz，另外一小部分数据采样率为250Hz。数据中如果QT间期与TOffse- QRS Onset的数值不一致，则排除该数据。此外有一部分数据没有标记P波的位置，所以也被排除。 最后Mdwvdb\_250Hz总共有1840组数据。Mdwvdb\_500Hz 总共有1405组数据，

我们采用如下标准来衡量算法性能。定义误差

|  |  |
| --- | --- |
|  | （公式一） |

其中x(n)为第n个数据的测量值，ref(n)为第n个数据的参考值

1. 误差的均值

|  |  |
| --- | --- |
|  | （公式二） |

1. 误差的方差

|  |  |
| --- | --- |
|  | （公式三） |

1. 误差小于某数值所占比重

|  |  |
| --- | --- |
|  | （公式四） |

s取值 5ms、10ms、20ms、40ms、100ms。

我们可以认为小于5ms为完美，5-10ms为优秀，10-20ms为良好，20-40为及格，

40-100为不及格。下图展现了不同QT间期误差的对比图。红色为参考标记，蓝色为计算获得的标记。误差值标在了图上。





## 二、波形特征点识别结果：

利用mdwvdb\_250Hz数据集，只利用了II导联的心电数据，测量八个指标与参考指标之间的差异。ptdetector\_Christov为2006年CINC，QT间期比赛中，第二名的方法。

这个指标可以认为是及格率。是良好率。

**Table1: result of ptdetector\_Christov**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | (ms) |  |  |  |  |  |  |
| QT间期 | 17.716 | 22.333 | 0.215 | 0.383 | 0.697 | 0.921 | 0.985 |
| QRS宽度 | 13.199 | 12.611 | 0.224 | 0.405 | 0.773 | 0.986 | 0.998 |
| PR间期 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| P Onset | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| P Offset | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| QRS Onset | 8.628 | 10.116 | 0.430 | 0.618 | 0.943 | 0.992 | 0.997 |
| QRS Offset | 17.302 | 9.296 | 0.127 | 0.222 | 0.524 | 0.991 | 0.999 |
| TOffset | 15.107 | 22.041 | 0.336 | 0.531 | 0.764 | 0.931 | 0.984 |

**Table2: result of ptdetector\_bin2 II导联**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | (ms) |  |  |  |  |  |  |
| QT间期 | 17.053 | 18.591 | 0.218 | 0.386 | 0.689 | 0.926 | 0.991 |
| QRS宽度 | 11.034 | 9.753 | 0.307 | 0.509 | 0.829 | 0.990 | 0.999 |
| PR间期 | 9.485 | 9.803 | 0.354 | 0.602 | 0.903 | 0.984 | 0.999 |
| P Onset | 7.772 | 10.045 | 0.533 | 0.744 | 0.929 | 0.987 | 0.997 |
| P Offset | 15.559 | 13.633 | 0.213 | 0.359 | 0.661 | 0.951 | 0.997 |
| QRS Onset | 8.333 | 6.743 | 0.411 | 0.615 | 0.951 | 0.995 | 1.000 |
| QRS Offset | 10.870 | 7.409 | 0.277 | 0.485 | 0.865 | 0.994 | 1.000 |
| TOffset | 14.341 | 17.781 | 0.334 | 0.529 | 0.759 | 0.934 | 0.990 |

**Table3: result of ptdetector\_medex（excel-原始.txt）**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | (ms) |  |  |  |  |  |  |
| QT间期 | 15.122 | 18.948 | 0.332 | 0.515 | 0.746 | 0.924 | 0.988 |
| QRS宽度 | 11.748 | 10.580 | 0.336 | 0.528 | 0.789 | 0.982 | 0.998 |
| PR间期 | 10.398 | 11.395 | 0.397 | 0.602 | 0.862 | 0.980 | 0.997 |
| P Onset | 8.709 | 12.675 | 0.498 | 0.715 | 0.913 | 0.984 | 0.995 |
| P Offset | 9.752 | 13.908 | 0.435 | 0.665 | 0.887 | 0.982 | 0.996 |
| QRS Onset | 6.115 | 7.002 | 0.582 | 0.854 | 0.979 | 0.995 | 0.999 |
| QRS Offset | 9.654 | 8.653 | 0.385 | 0.615 | 0.872 | 0.990 | 0.999 |
| TOffset | 13.141 | 19.381 | 0.428 | 0.613 | 0.809 | 0.938 | 0.988 |

**Table4: result of ptdetector\_medex（excel-修改QS.txt）**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | (ms) |  |  |  |  |  |  |
| QT间期 | 22.457 | 28.749 | 0.205 | 0.362 | 0.638 | 0.837 | 0.972 |
| QRS宽度 | 33.401 | 34.060 | 0.063 | 0.156 | 0.525 | 0.728 | 0.932 |
| PR间期 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| P Onset | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| P Offset | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| QRS Onset | 8.336 | 13.376 | 0.660 | 0.811 | **0.880** | 0.930 | 1.000 |
| QRS Offset | 27.879 | 29.222 | 0.078 | 0.227 | 0.623 | 0.775 | 0.960 |
| TOffset | 18.735 | 25.181 | 0.249 | 0.418 | 0.712 | 0.893 | 0.975 |

**Table5 结合8个导联的信息进行QT检测**

wavepos(1:3) = wavepos8(2,1:3); % P 波采用II导联

wavepos(4:5) = waveposabs(4:5); % Qonset采用abs

wavepos(6) = tmp(6); % Qend采用median

% wavepos(3) = tmp(3);

wavepos(7:9) = tmp(7:9); % Tend 采用meidan

加入修正

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | (ms) |  |  |  |  |  |  |
| QT间期 | 10.358 | 23.054 | 0.379 | 0.618 | **0.896** | **0.972** | 0.997 |
| QRS宽度 | 6.288 | 12.220 | 0.493 | 0.808 | **0.977** | **0.998** | 0.999 |
| PR间期 | 7.370 | 9.913 | 0.507 | 0.748 | **0.935** | **0.985** | 0.998 |
| P Onset | 6.833 | 10.151 | 0.631 | 0.805 | **0.931** | **0.986** | 0.997 |
| P Offset | 11.872 | 14.680 | 0.389 | 0.585 | **0.826** | **0.947** | 0.997 |
| QRS Onset | 1.891 | 6.198 | 0.977 | 0.984 | **0.990** | **0.997** | 0.999 |
| QRS Offset | 5.733 | 17.040 | 0.652 | 0.903 | **0.982** | **0.998** | 0.999 |
| TOffset | 9.926 | 27.654 | 0.480 | 0.702 | **0.898** | **0.974** | 0.996 |