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MIT-BIH Arrhythmia Database Directory

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Introduction

This introduction describes how the database records were obtained, and discusses the characteristics of the recorded signals. Following these notes are annotated ``full disclosure'' plots of the entire database. These can be useful for obtaining an overall impression of the contents of individual records. Following the ``full disclosure'' plots are sample ECG strips. These strips were chosen to illustrate the salient features of each record. Next are notes on the important features of each record. These notes also include background information on the subjects, including their medications. At the end of the book are tables of rhythms and annotations, which summarize the contents of the database. These tables can be helpful in finding a record with a specific set of characteristics.

这个简介描述数据库记录是如何获得的，讨论记录信号的特征。接下来是整个数据库的带标注的“完全公开”图。对获得单个记录内容的整体印象有用处。接下来是抽取的ECG 图带（ECG片段）。这些片段被选取出来用作显示每个记录的突出特征。接下来是每个记录重要特征的注解。这些注解也包括 研究对象的背景信息，包括他们的治疗用药。在书的最后 是节律和注释的表格，总结了数据库的内容。这些表格对查找带有特殊特征的记录 会有帮助。

Selection criteria

选择准则

The source of the ECGs included in the MIT-BIH Arrhythmia Database is a set of over 4000 long-term Holter recordings that were obtained by the Beth Israel Hospital Arrhythmia Laboratory between 1975 and 1979.

MIT-BIH 心律失常数据库包含的ECG 的来源是 1975 到1979年间Beth Israel 医院采集的4000 多个长时间Holter 记录。

Approximately 60% of these recordings were obtained from inpatients. The database contains 23 records (numbered from 100 to 124 inclusive with some numbers missing) chosen at random from this set, and 25 records (numbered from 200 to 234 inclusive, again with some numbers missing) selected from the same set to include a variety of rare but clinically important phenomena that would not be well-represented by a small random sample of Holter recordings. Each of the 48 records is slightly over 30 minutes long.

大约60% 的记录是从住院病人获得的。数据库包含23个记录（编号从100 到124，有一些编号不对应记录）是在这数据集中随机选取的，有25个记录（编号200到234，有一些编号不对应记录）是从同一个数据集选取用来包含多种常见的但是临床上重要的现象，这些现象不能 通过Holtor记录的小随机样本 很好的表示。48个记录的每一个记录l是30分钟多一点。

The first group is intended to serve as a representative sample of the variety of waveforms and artifact that an arrhythmia detector might encounter in routine clinical use. A table of random numbers was used to select tapes, and then to select half-hour segments of them. Segments selected in this way were excluded only if neither of the two ECG signals was of adequate quality for analysis by human experts.
第一组是打算用来代表 心律失常检测器在日常临床使用中可能遇到的各种各样的波形和伪迹 的样本。一个随机数表格用来选择ECG磁带，然后选择半小时的片段。这种方式选择的片段 在两个导联上的信号都没有足够好的信号质量供人类专家来分析的情况下 会被排除。

Records in the second group were chosen to include complex ventricular, junctional, and supraventricular arrhythmias and conduction abnormalities. Several of these records were selected because features of the rhythm, QRS morphology variation, or signal quality may be expected to present significant difficulty to arrhythmia detectors; these records have gained considerable notoriety among database users.
第二组中选择的记录 用来包含复杂的室性，交界性，室上性心律失常和传导异常。有一些记录被选择进来是因为节律，QRS形态或信号质量上的特征 预计可能对心律失常检测器 产生非常大的困难；这些记录 因为分析上的困难 在数据库的用户中 非常有名。

The subjects were 25 men aged 32 to 89 years, and 22 women aged 23 to 89 years. (Records 201 and 202 came from the same male subject.)
研究对象包括 25 个男性 年龄从32 到89岁，22名女性年龄从23到89岁。（记录201和202 来自同一个男性研究对像）

ECG lead configuration
ECG导联配置

In most records, the upper signal is a modified limb lead II (MLII), obtained by placing the electrodes on the chest. The lower signal is usually a modified lead V1 (occasionally V2 or V5, and in one instance V4); as for the upper signal, the electrodes are also placed on the chest. This configuration is routinely used by the BIH Arrhythmia Laboratory.
在大多记录中，上面（第一个）信号是修正肢体导联II(MLII)，通过放置在胸部的电极获得。下面（第二个）信号通常是修正导联V1（偶尔是V2或V5，在一个记录中是V4）；和第一个信号一样，电极也放置在胸部。 这种导联配置常被BIH 心律失常实验室使用。

Normal QRS complexes are usually prominent in the upper signal. The lead axis for the lower signal may be nearly orthogonal to the mean cardiac electrical axis, however (i.e., normal beats are usually biphasic and may be nearly isoelectric).
正常QRS复合波 通常在第一个导联特征显著。第二个信号导联轴差不多与平均心电轴正交（也就是说，正常心拍常常是双相的和近似等电位的）。

Thus normal beats are frequently difficult to discern in the lower signal, although ectopic beats will often be more prominent (see, for example, record 106). A notable exception is record 114, for which the signals were reversed. Since this happens occasionally in clinical practice, arrhythmia detectors should be equipped to deal with this situation. In records 102 and 104, it was not possible to use modified lead II because of surgical dressings on the patients; modified lead V5 was used for the upper signal in these records.
因此，正常心拍 在第二个信号中 经常很难识别，尽管异位心拍常常更为突出（例如 记录106）。一个值得注意的例外是记录114，该记录信号与上面的情况相反。由于这种情况在实际临床中偶然会出现，心律失常检测器应该 具备处理这种情况的能力。在记录102 和104，使用修正II导联是不可能的，因为病人身上有外科手术的绷带；在这些记录中第一个信号用了修正导联V5。

Analog recording and playback
模拟记录及回放

The original analog recordings were made using nine Del Mar Avionics model 445 two-channel recorders, designat
A through *I*:
原始的模拟记录是用 9个 Del Mar Avionics 公司 型号445 双通道 记录仪 制作的， 从A 到I 命名记录仪:

Recorder	*Records*
A	102, 107, 111, 115, 121
B	212
C	203
D	118, 124, 217
E	101, 103, 106, 108, 112, 117, 119, 122, 209, 219, 220, 223, 233
F	104, 109, 123, 205, 207, 210, 215, 221
G	100, 105, 114, 116, 213, 214, 222, 228
H	113, 201, 202, 231
I	200, 230, 232, 234

(It is not known which recorder was used for record 208.)
(不知道记录208 用的那个记录仪)

During the digitization process, the analog recordings were played back on a Del Mar Avionics model 660 unit.
在数字化过程中，模拟记录 在 Del Mar Avionics 公司 型号 660 装置上 播放。

The analog tapes used for records 112, 115 through 124, 205, 220, 223, and 230 through 234 were played back and digitized at twice real time; the rest were played back at real time using a specially constructed capstan for the model 660 unit.
记录112，115 到124，205，220，223，230到234 的模拟磁带 在第二次实时 回放并数字化； 其余的 利用 型号660 装置 专门的构建绞盘 实时的回放 。

Skew between the two signals was found to be as great as 40 milliseconds for some of the analog recorders.
对某些模拟记录 发现 两个信号之间的 偏移 大到 40 毫秒。

In addition to the fixed skew that results from extremely small differences in the orientations of the tape heads on the recorder and the playback unit, microscopic vertical wobbling of the tape, either during recording or playback, introduces a variable skew, which may be comparable in magnitude to the fixed skew.
除了由 记录仪和回放单元磁头方向上极小的差别 导致的固定的偏移之外， 在记录或回放过程中，磁带垂直方向微小的颤动 引入变化的偏移，幅度 比得上 固定的偏移。

This problem (which also occurs on the AHA database) may present difficulties for certain two-channel analysis methods designed for real-time applications.
这个问题（AHA 数据库也有此问题）可能给 为实时应用而设计的 一些双通道分析方法 带来困难。

Minor tape speed variations should not pose problems for typical arrhythmia detectors. It is difficult to avoid tape sticking or slippage during low-speed playback, and several episodes of tape slippage were noted and marked with comment annotations.
小的磁带速度变化 不应该 对典型心律失常检测器 造成问题。很难避免磁带 低速回放过程中的 粘着或滑动，几处磁带产生滑动的片段 用注释符号 进行了注释或标记。

Wow and flutter should be studied carefully in the context of heart-rate variability studies, since flutter compensation was not possible in these recordings.
摇晃和抖动 在心率变异性研究方面 应该认真的研究，因为这这些记录中 不可能对抖动进行补偿（校正）。

A number of frequency-domain artifacts have been identified and related to specific mechanical components of the recorders and the playback unit:
许多 频域的伪迹 已经被识别出来 并且 找到了和记录仪和播放单元具体机械部件的关系：

Frequency (Hz)	*Source*
0.042	Recorder pressure wheel
0.083	Playback unit capstan (for twice real-time playback)
0.090	Recorder capstan

0.167	Playback unit capstan (for real-time playback)
0.18-0.10	Takeup reel (frequency decreases over time)
0.20-0.36	Supply reel (frequency increases over time)

0.042 Hz ----------录音机压力轮
0.083 Hz ----------回放单元绞盘（第二次实时回放）
0.090 Hz ----------录音机绞盘
0.167 Hz ----------回放单元绞盘（实时回放）
0.18-0.10 Hz ----------收带卷轴（频率随时间减小）
0.20-0.36 Hz ----------放带卷轴（频率随时间增加）

The most significant of these artifacts by far is the 0.167 Hz artifact on recordings that were played back at real time.
到目前为止，最为严重的是 实时回放记录时的 0.167 Hz 伪迹。

The next largest is the 0.090 Hz artifact; the 0.083 Hz artifact on recordings that were played back at twice real-time is of roughly the same magnitude as the 0.090 Hz artifact. The 0.042 Hz artifact is of much lower magnitude. Other frequencies related to the drive train (at 0.42 Hz, 1.96 Hz, 9.1 Hz, and 42 Hz) do not appear as noticeable artifacts. The frequencies of the last two artifacts listed in the table depend on how much tape is on the supply and takeup reels; the supply reel causes a much more noticeable artifact than does the takeup reel. Other frequency-domain artifacts generated by the supply reel appear in the 0.10-0.18 Hz and 0.30-0.54 Hz bands.
Four of the 48 records (102, 104, 107, and 217) include paced beats. The original analog recordings do not represent the pacemaker artifacts with sufficient fidelity to permit them to be recognized by pulse amplitude (or slew rate) and duration alone, the method commonly used for real-time processing. The database records reproduce the analog recordings with sufficient fidelity to permit use of pacemaker artifact detectors designed for tape analysis, however.
接下来最大的是0.090 Hz 伪迹， 第二次实时回放 引入的0.083Hz 伪迹 大约和0.090Hz伪迹有相同幅度。0.042Hz伪迹幅度低得多。与传动系统相关的其它频率（0.42 Hz, 1.96 Hz, 9.1 Hz, 42 Hz）没出现明显的伪迹。表中列出的最后两个伪迹的频率依赖于在放带和收带卷轴上还有多少磁带；放带卷轴 比 收带卷轴 引入 更加明显的伪迹。由放带卷轴产生的其它频率域上的伪迹 出现在 0.10-0,18Hz 和0.30-0.54Hz频段。 48个记录中有4个（102，104，107，217）包含起搏心拍。原始的模拟记录没有 以足够的保真度 表示起搏器伪迹， 足够的保真度 可以允许伪迹 仅通过脉冲幅度（或斜率）和时限 被识别出来，这种方法常用于实时处理。然而， 数据库记录重新生成具有足够保真度的模拟记录 从而允许 为对磁带分析而设计的起搏器伪迹检测器 的使用。

Digitization
数字化
The analog outputs of the playback unit were filtered to limit analog-to-digital converter (ADC) saturation and for anti-aliasing, using a passband from 0.1 to 100 Hz relative to real time, well beyond the lowest and highest frequencies recoverable from the recordings.
回放装置的模拟输出被滤波 以限定 模拟-数字转换（ADC)饱和度 和 抗混叠，利用 通带 0.1到100Hz 相对实时的滤波，远远超出了从模拟记录可以恢复的最低 和最高频率。

The bandpass-filtered signals were digitized at 360 Hz per signal relative to real time using hardware constructed at the MIT Biomedical Engineering Center and at the BIH Biomedical Engineering Laboratory.
带通滤波后 每个信号相对实时的 以360 Hz 速率 被数字化，使用MIT 生物医学工程中心和BIH 生物医学工程实验室搭建的硬件。

The sampling frequency was chosen to facilitate implementations of 60 Hz (mains frequency) digital notch filters in arrhythmia detectors.
Since the recorders were battery-powered, most of the 60 Hz noise present in the database arose during playback. In those records that were digitized at twice real time, this noise appears at 30 Hz (and multiples of 30 Hz) relative to real time.
采样率的选择 是为了便于 心律失常检测器中 60Hz（工频） 数字陷波的实现。由于记录仪用电池供电，出现在数据库中的大多数60Hz 噪声是在回放过程中引入的。 那些 在第二次实时回放被数字化的 记录中，相对于实时数字化记录 这种噪声出现在30Hz(及30Hz 整数倍)处。

Samples were acquired from each signal almost simultaneously (the intersignal sampling skew was on the order o

few microseconds). As noted above, analog tape skew was several orders of magnitude larger. The ADCs were unipolar, with 11-bit resolution over a ±5 mV range. Sample values thus range from 0 to 2047 inclusive, with a value of 1024 corresponding to zero volts.
从每个信号几乎同时地获取采样值（ 信号间的（通道间的）采样偏移是在几个微妙的级别上）。如上所述，模拟磁带的偏移 幅度上 大好几级别。 模数转换器是单极的，11 位分辨率，信号范围±5 mV。 因此采样值在0到2047 的范围内，1024 对应0伏。

The 11-bit samples were originally recorded in 8-bit first difference format (this was necessary because of limited mass storage capacity). Given the sampling frequency and the resolution of the ADC, the difference encoding implies a maximum recordable slew rate of ±225 mV/s. In practice, this limit was exceeded by the input signals very infrequently, only during severe noise on a small number of records. The effect on the quality of the recorded signals is totally negligible. On this CD-ROM, the samples have been reconstructed from the first differences and stored as pairs of 12-bit amplitudes packed in triplets of consecutive bytes (for details on the storage format, see signal(5)). 、11 位采样值起初 用 8位一阶差分的 格式记录（由于大容量存储能力的限制，这么做是必要的）。所给ADC的采样率和分辨率，差分编码意味着最大可记录斜率是±225 mV/s。 在现实中，这个限制 很少被输入信号超出，仅在少量记录上 出现一些噪声时超过此界限。这对记录信号质量的影响完全可以忽略。在光盘上，采样值被 从一阶差分 重建并用 12位幅值对打包成连续三个字节构成的组 的格式存储（关于存储格式的细节 参见 signal（5））。

Annotations
注释
An initial set of beat labels was produced by a simple slope-sensitive QRS detector, which marked each detected event as a normal beat.
起初的心拍标识是由一个简单的对斜率敏感的QRS检测器产生的，标记每个检测到的事件并 看做正常心拍。

Two identical 150-foot chart recordings were printed for each 30-minute record, with these initial beat labels in the margin.
对每一个30分钟记录，两个相同长度的 150 英尺的卷图 被打印出来，在边缘带有初始的心拍标签。

For each record, the two charts were given to two cardiologists, who worked on them independently. The cardiologists added additional beat labels where the detector missed beats, deleted false detections as necessary, and changed the labels for all abnormal beats. They also added rhythm labels, signal quality labels, and comments.
对每一个记录，两个卷图 交给两个心脏病学家， 他们独立地工作。心脏病学家添加额外的心拍标识 在检测器漏掉的心拍，检测错误的心拍，对改变所有异常心拍标识。他们也添加节律标识，信号质量标识，注释。

The annotations were transcribed from the paper chart recordings. Once both sets of cardiologists' annotations for a given record had been transcribed and verified, they were automatically compared beat-by-beat, and another chart recording was printed. This chart showed the cardiologists' annotations in the margin, with all discrepancies highlighted. Each discrepancy was reviewed and resolved by consensus. The corrections were transcribed, and the annotations were then analyzed by an auditing program, which checked them for consistency and which located the ten longest and shortest R-R intervals in each record (to identify possible missing or falsely detected beats).
注释 从纸质的图标记录上转录下来。一旦心脏病学家 对一个给定记录的 两组注释的 转录 与核实完成，它们自动地逐拍比较，另一个图表记录被打印。这个图表 在边缘显示心脏病学家的标注，所有的差异被凸显出来。每一处差异被重新审查并经协商一致后决定。更正被转录，注释 然后 用一个审核程序进行分析，检查它们的一致性 并且 在每一个记录中定位10个最长和最短的RR间期（用来识别可能遗漏或错误检测的心拍）。

In early copies of the database, most beat labels were placed at the R-wave peak, but manually inserted labels were not always located precisely at the peak. In copies of the database made since 1983, the beat labels have been shifted from their original locations.
在数据库早期的副本中，大多心拍标签被置于R波峰值点，但是手工的插入标签不总是定位到精确的峰值点。自从1983年制作的数据库副本中，心拍标签 从原始的位置上 做了移动。

The ECG (usually the upper signal) was digitally bandpass-filtered to emphasize the QRS complexes, and each bea label was moved to the major local extremum, after correction for phase shift in the filter. A few noisy beats were manually realigned.

ECG （通常是第一个信号）经数字带通滤波处理 以 突出QRS复合波，在对滤波的相移校准之后，每个心拍标签被移动到最大局部极值点。 许多噪声污染严重的心拍手工进行了对齐调整。
This process was applied to all records except record 117 in 1983; the beat labels for record 117 were not realigned until March 1998, however.
在1983年，这个处理过程应用到 除117 以外的 所有记录； 记录117的心拍标签 没有被重新调整 直到 1998 年三月。

The result is that annotations generally appear at the R-wave peak, and are located with sufficient accuracy to make the reference annotation files usable for studies requiring waveform averaging and for heart rate variability studies (but note the comments with respect to analog tape wow and flutter above).
结果是 注释一般出现在R波峰值点，定位足够精确， 使得参考注释文件可用于 要求波形平均的研究 和 心率变异性研究（但要注意到 上面 关于模拟磁带晃动和抖动的注解）。

In the annotated ECG plots produced by `psfd` and `pschart`, and in printed copies of this directory, each label is placed so that the fiducial mark for the annotation corresponds to the left edge of the label.
在 psfd 和 pschart 生成的带标注的ECG图中，及在 这个目录的打印副本中，每个标签被标出， 标签的左侧边缘对应着 该标注的基准点（对起点）。

The database contains approximately 109,000 beat labels. Sixteen were corrected in the first seven years after the database was released in 1980 (in records 104, 108, 114, 203, 207, 217, and 222);
数据库包含大约109，000 个心拍标记。在1980年数据库发布后的头7年里 有16 处被更正（在记录104，108，114，203，207，217，222 中）；

in addition, all of the left bundle branch block beats in record 214 were originally labelled as normal beats.
此外，记录214 中所有左束支阻滞心拍 起初是标记为正常心拍。

The rhythm labels have been more substantially revised and now include notations for paced rhythm, bigeminy, and trigeminy, which were missing in early copies.
节律的标注 做了 很大修改 ，现在包括 起搏节律，二联率，三联律 的注释，这些是在早期副本中找不到的。

In October 1998, a rhythm label in record 203 was corrected.
1998 年 10月，记录203 中节律标识被更正。

In October 2001, a seventeenth error in the beat labels was discovered and corrected (in record 209).
2001年10月，心拍标识中的第十七个错误被发现和更正（记录209中）。

In April 2003, 26 PVC annotations in record 119 were manually realigned by small amounts (up to 74 ms).
2003 年四月，记录119中 26 个PVC 注释 被手工 微调 重新对齐 （直到74ms）。

In May 2003, an eighteenth error in the beat labels was discovered and corrected (in record 214).
2003 年五月，心拍标注的第十八个错误被发现 和更正（记录214）。

In April 2005, many of the episodes previously labelled as atrial fibrillation in record 222 were partially or completely relabelled as atrial flutter.
2005 年4月，记录222 中先前 标记为 房颤 的很多 片段 部分地 或全部地 重新标注为 房扑。

In April 2008, three beat labels were corrected (two in record 108, and one in record 215).
2008 年四月，三个心拍标记被更正（108 中有两个，215 中有一个）。

In June 2010, the 22nd and 23rd errors in the beat labels were found and corrected (both in record 203).
2010 年6 月，心拍标记中的第22，23个错误被发现和更正（都在203中）。

Thanks to Bob Bruce, Pat Hamilton, Yin Dengfeng（尹登峰）, Roger Mark, Sebastian Vasquez, and Mariano Llam Soria for finding and reporting these errors.

Symbols used in plots
绘图用符号

[An expanded and updated version of the table below can be found at http://www.physionet.org/physiobank/annotations.shtml.]
扩充和更新的下表，可以在。。。。。找到。

Symbol	***Meaning***
· *or* N	Normal beat ----------正常心拍
L	Left bundle branch block beat ----------左束支阻滞心拍
R	Right bundle branch block beat ----------右束支阻滞心拍
A	Atrial premature beat ----------房性早搏心拍
a	Aberrated atrial premature beat ----------异常的（发生畸变的）房性早搏心拍
J	Nodal (junctional) premature beat ----------结（交界）性早搏心拍
S	Supraventricular premature beat ----------室上性早搏心拍
V	Premature ventricular contraction ----------室性期前收缩
F	Fusion of ventricular and normal beat ---------室性与正常心拍的融合波
[	Start of ventricular flutter/fibrillation ----------心室扑动/纤颤 的起点
!	Ventricular flutter wave ----------心室扑动波
]	End of ventricular flutter/fibrillation ----------心室扑动/纤颤 的终点
e	Atrial escape beat ----------房性逸搏心拍
j	Nodal (junctional) escape beat ----------结（交界）性逸搏心拍
E	Ventricular escape beat ----------室性逸搏心拍
/	Paced beat ----------起搏心拍
f	Fusion of paced and normal beat ----------起搏和正常心拍的融合波
x	Non-conducted P-wave (blocked APB) ---------未下传P波（阻滞的 房性早搏心拍）
Q	Unclassifiable beat ----------未分类心拍
|	Isolated QRS-like artifact ----------孤立的类似QRS的伪迹
Rhythm annotations appear *below* the level used for beat annotations: 节律注释符号级别低于心拍注释符号：	
(AB	Atrial bigeminy ----------房性二联率
(AFIB	Atrial fibrillation ----------房颤
(AFL	Atrial flutter ----------房扑
(B	Ventricular bigeminy ----------室性二联率
(BII	2° heart block ----------2 度心脏阻滞
(IVR	Idioventricular rhythm ----------心室自主节律
(N	Normal sinus rhythm ----------正常窦性节律
(NOD	Nodal (A-V junctional) rhythm ----------结（房室交界）性节律
(P	Paced rhythm ----------起搏节律
(PREX	Pre-excitation (WPW) ----------预激综合征
(SBR	Sinus bradycardia ----------窦性心动过缓
(SVTA	Supraventricular tachyarrhythmia ---------室上性 心动过速
(T	Ventricular trigeminy ---------- 室性三联律
(VFL	Ventricular flutter ----------心室扑动
(VT	Ventricular tachycardia ----------室性心动过速
Signal quality and comment annotations appear *above* the level used for beat annotations: 信号质量和注解的注释符号级别高于心拍标记符号的水平：	
qq	Signal quality change: the first character (`c' or `n') indicates the quality of the upper signal (clean or noisy), and the second character indicates the quality of the lower signal ----------信号质量变化：第一字符（c 或n)表示第一个信号的质量（干净或干扰大），第二个字符表示第二个信号质量。

U	Extreme noise or signal loss in both signals: ECG is unreadable ----------在两个信号上都有极严重的噪声或信号缺失：ECG不能读取
M (*or* MISSB)	Missed beat ----------漏掉的心拍（心脏在该位置少一个搏动）
P (*or* PSE)	Pause ----------（心脏）暂停
T (*or* TS)	Tape slippage ----------磁带滑动

上一篇>> WFDB 软件包介绍 下一篇>> FortuneClient-Qt4自带例子

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网友评论

1 **iamyy895** 2011-08-19 11:25 回复

很牛 很厉害

发表评论

姓 名： hefanr

内 容：

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