睡眠呼吸暂停与低通气综合征（Sleep apnea and hypopnea syndrome，SAHS）是一种常见的睡眠呼吸障碍，患者在睡眠时常常伴有完全的（apnea）或者部分的（hypopnea）呼吸停滞[1]。

据估计在中年人中有2%的女性与4%的男性患有睡眠呼吸暂停综合征[2]。

阻塞性睡眠呼吸暂停综合征会引起嗜睡、道路交通安全并且可能引发全身性高血压，甚至还与心肌梗死、充血性心力衰竭、中风以及糖尿病等病症有关[3]。

患者睡眠时呼吸不畅引起血氧饱和度下降、高碳酸血症、睡眠质量下降等症状，并引起睡眠呼吸暂停综合征的并发症—心血管疾病、代谢异常、神经认知障碍等[3]。

睡眠呼吸暂停综合征是一种全球性的疾病，欧洲亚洲美洲都存在这种病征。

在睡眠多导图中，脑电图（EEG）、左右眼电图（EOG）与颏下肌电图（EMG）用来对患者进行睡眠分期。

诊断SAHS的金标准是在实验室中进行测量的睡眠多导图（Polysomnography，PSG）。睡眠呼吸专家根据测量得到的PSG标注出患者的AHI指数（每小时内发生的apnea、hypopnea事件次数）诊断出患者的SAHS严重程度。但是PSG存在着几个限制：1.PSG要求患者佩戴昂贵的监测系统在实验室睡眠至少一晚；2.睡眠呼吸专家通过得到的离线数据对患者的SAHS严重程度做出判断，需要花费大量的时间与精力。所以近些年来许多学者希望能够从有限的生理信号通道入手以简化甚至替代PSG诊断的过程。采用的方法主要分为两种，一种是基于事件的检测方法[4-10]，一种是基于整体信号特征的检测方法[11-16]。最先被用来诊断SAHS的是ECG信号，McNames等人发现ECG信号中的心率、S波复制等特征与SAHS相关[16]。Oguzhan等人使用K近邻方法（K-Near-Neighbor，KNN）对从ECG信号中提取得到的心率变异性等特征进行分类从而实现对SAHS患者的预测[14]。Bsoul等人通过将ECG信号切割成一分钟的片段使用支持向量机（Support Vector Machine，SVM）的方法实现对SAHS的实时诊断[7]。同时在近些年一些研究采用与SAHS更加直接相关的口鼻流量信号与血氧信号对SAHS进行诊断。比如Gutierrez等人使用AdaBoost的方法基于单通道流量信号的特征实现对SAHS严重程度的诊断[11]。B.Xie等人使用分类器组合的方法基于ECG与血氧的双通道信号特征集合实现了对SAHS的实时判断[6]。最近两年Choi, S. H.等人使用卷积神经网络的方法基于单通道口鼻压力信号一方面实现了对SAHS事件的高分辨率实时检测，另一方面还可以实现对SAHS严重程度的诊断[4]。Jung, D. W.等人使用基于规则的回归模型基于血氧的形态学特征实现对SAHS的实时检测与严重程度的诊断[5]。以上两种方法中使用信号整体特征实现对SAHS诊断的方法不能够提供相关SAHS事件的时间信息，在临床诊断中可能会带来不便；基于事件检测的SAHS诊断方法目前来说使用卷积神经网络可以达到较高的分辨率与准确度，但是需要注意的是一方面卷积神经网络缺乏解释性，可能会在临床诊断中带来困扰，另外一方面需要大量的样本数据进行训练同时计算量巨大，可能会给临床应用带来不便。所以我们希望探索具有较强解释性的决策树的方法在SAHS诊断中的可行性，在实现中为了解决切割窗口选择的问题采用了级联分类器的设计，选用的信号为口鼻流量信号与血氧信号，口鼻流量信号可以弥补血氧信号延后的问题，而血氧信号可以为口鼻流量信号提供更多的参考信息，两者的组合具有更高的抗干扰性。

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