

# 图引擎服务开发指南

文档版本

01

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# 1 简介

## 图引擎服务概述

图引擎服务（Graph Engine Service，简称GES），是针对以“关系”为基础的“图”结构数据，进行查询、分析的服务。广泛应用于社交关系分析、推荐、精准营销、舆情及社会化聆听、信息传播、防欺诈等具有丰富关系数据的场景。

## 开发指南概述

图引擎服务软件开发工具包（GES SDK，Graph Engine Service Software Development Kit）是对GES提供的REST API进行的封装，以简化用户的开发工作。用户直接调用GES SDK提供的接口函数即可实现使用GES服务业务能力的目的。

## 内容导航

GES开发指南将指导您如何安装和配置开发环境、如何通过调用GES SDK提供的接口函数进行二次开发。

章节	内容
简介	简要介绍本服务和开发指南的概念。
准备工作	介绍使用GES SDK前的环境配置和下载SDK。
工程导入	介绍导入工程的方法。
使用业务面SDK	介绍使用业务面GES SDK进行的常用操作。
使用管理面SDK	介绍使用管理面GES SDK进行的常用操作。
SDK和REST API的关系	介绍GES SDK与REST API的关系。

# 2 准备工作

## 准备环境

- 已从[Oracle官网](#)下载并安装JDK1.8或以上版本，配置好JAVA环境变量。
- 已从[Eclipse官网](#)下载并安装Eclipse IDE for Java Developers最新版本。
- 已在Eclipse中配置好JDK。

## 下载 SDK

进入图引擎服务管理控制台，在左侧导航栏选择“连接管理”，进入SDK下载页面。具体操作请参见[连接管理操作指导](#)。

# 3 工程导入

## 外部 jar 包打入本地 maven 仓库

1. 解压huaweiCloud-ges-sdk-java-xxx.zip，进入解压后该目录下的maven-install目录中，执行ges-sdk-java-maven-install.bat文件或ges-sdk-java-maven-install.sh文件，将sdk-common-xxx.jar、ges-sdk-xxx.jar、graph-sdk-xxx.jar、cypher-jdbc-driver-xxx.jar以及java-sdk-core-xxx.jar安装到本地maven仓库。
2. 创建maven工程，在pom文件中导入依赖即可。

```
<dependency>
    <groupId>com.huawei.ges</groupId>
    <artifactId>ges-sdk</artifactId>
    <version>xxx</version> //此处需要输入当前管理面sdk的版本号
</dependency>

<dependency>
    <groupId>com.huawei.ges.graph</groupId>
    <artifactId>graph-sdk</artifactId>
    <version>xxx</version> //此处需要输入当前业务面sdk的版本号
</dependency>
<!-- 使用cypher jdbc驱动时引入 -->
<dependency>
    <groupId>com.huawei.ges</groupId>
    <artifactId>cypher-jdbc-driver</artifactId>
    <version>xxx</version> //此处需要输入cypher-jdbc-driver的版本号
</dependency>
```

## 本地导入 jar 包

新建工程，解压huaweiCloud-ges-sdk-java-xxx.zip，进入huaweiCloud-ges-sdk-java-xxx目录，将jars目录下的ges-sdk-xxx-jar-with-dependencies.jar、graph-sdk-xxx-jar-with-dependencies.jar导入工程或者将ges-sdk-xxx.jar、graph-sdk-xxx.jar、cypher-jdbc-driver-xxx.jar以及libs目录下所有包导入工程皆可。

# 4 使用业务面 SDK

## 4.1 初始化 GES 业务面客户端

使用GES SDK工具访问GES，需要用户初始化GES客户端。

- 通过内网访问时，endpoint为GES Console界面上的私网IP或者图详情查询API返回结果里面的“privatelp”字段；
- 通过公网访问时，endpoint为GES Console界面上的公网IP或者图详情查询API返回结果里面的“publicip”字段。

示例代码如下：

```
String endPoint = "endpoint";
String version = "v1.0";
String projectId = "project_id";
String graphName = "graph_name";
//注意：公网访问时，必须使用TOKEN认证方式，且须提供下面的domainName, userName, password
String regionName = "region_name";
String domainName = "domain_name";
String userName = "user_name";
String password = "user_password";
String userId = "userId";

GraphInfo graphInfo = new GraphInfo(endPoint, version, projectId, userId, graphName, regionName,
domainName, userName, password);
//生成graph client并初始化，初始化时默认生成了与图名称同名的对象，供后续gremlin命令直接使用。
GraphClient graphClient = new GraphClient(AuthenticationMode.TOKEN,graphInfo);
```

### 说明

- graphName、私网IP及公网IP可在GES Console上的“图管理”页面查看，具体请参考[图管理简介](#)。
- regionName、domainName、userName、userId、projectId的获取方法：在GES Console界面上鼠标移动至右上方的用户名，在下拉列表中选择“我的凭证”。进入个人设置界面，项目即为regionName，domainName为账号名，userName为IAM用户名，userId为IAM用户ID，项目ID即为projectId。



## 4.2 点过滤查询

GES提供点过滤查询接口，您可以使用该接口查询满足过滤条件的顶点集合。示例代码如下：

```
public static void vertexQuery(GraphClient graphClient) throws ApiException
{
    //点过滤查询请求
    VertexFilterQueryReq req = new VertexFilterQueryReq();
    List<String> labels = new ArrayList<>();
    labels.add("movie");
    //按label过滤点
    req.setLabels(labels);
    //设置offset和limit
    req.setOffset(0);
    req.setLimit(5);
    //发送请求，拿到异步API结果
    AsyncAPIResp asyncAPIResp = graphClient.vertexQuery(req);
    //点过滤查询为异步API，取出jobId
    String jobId = asyncAPIResp.getJobId();
    //点查询Job请求
    VertexQueryJobReq req1 = new VertexQueryJobReq();
    //设置jobId
    req1.setJobId(jobId);
    //获取job查询结果
    JobResp<QueryData<VertexQueryResult>> resp = graphClient.queryJobStatus(req1);
    System.out.println(resp);
}
```

## 4.3 边过滤查询

GES提供校验边过滤查询接口，您可以使用该接口查询满足过滤条件边的集合。示例代码如下：

```
public static void edgeQuery(GraphClient graphClient) throws ApiException
{
    //设置边过滤查询
    EdgeFilterQueryReq req = new EdgeFilterQueryReq();
    //按label过滤边
    List<String> labels = new ArrayList<>();
    labels.add("rate");
    req.setLabels(labels);
```

```
//设置offset和limit，限制结果个数  
req.setOffset(0);  
req.setLimit(5);  
AsyncAPIResp resp = graphClient.edgeQuery(req);  
String jobId = resp.getJobId();  
EdgeQueryJobReq req1 = new EdgeQueryJobReq();  
req1.setJobId(jobId);  
System.out.println(graphClient.queryJobStatus(req1));  
}
```

## 4.4 查询节点详情

您可以使用GES提供的接口查询节点详情，示例代码如下：

```
public static void getVertices(GraphClient graphClient) throws ApiException  
{  
    VertexDetailReq req = new VertexDetailReq();  
    req.setVertexIds("46");//此处需要用户替换为实际的点ID  
    VertexDetailResult vertexDetailResult = graphClient.getVertices(req);  
    System.out.print(vertexDetailResult);  
}
```

## 4.5 查询边详情

您可以使用GES提供的接口查询边详情，示例代码如下：

```
public static void getEdge(GraphClient graphClient) throws ApiException  
{  
    EdgeDetailReq req = new EdgeDetailReq();  
    req.setSource("46");//此处需要用户替换为实际的点ID  
    req.setTarget("38");//此处需要用户替换为实际的点ID  
    req.setIndex(0);  
    EdgeDetailResult edgeDetailResult = graphClient.getEdge(req);  
    System.out.print(edgeDetailResult);  
}
```

## 4.6 查询图元数据详情

您可以使用GES提供的接口查询元数据详情。示例代码如下：

```
public static void getSchema(GraphClient graphClient) throws ApiException  
{  
    Map result = graphClient.getGraphSchema();  
    //用MapUtils工具类格式化输出  
    System.out.print(MapUtils.map2json(result));  
}
```

## 4.7 查询图概要信息

您可以使用GES提供的接口查询图概要信息。示例代码如下：

```
public static void getSummary(GraphClient graphClient) throws ApiException  
{  
    Map result = graphClient.getGraphSummary();  
    //用MapUtils工具类格式化输出  
    System.out.print(MapUtils.map2json(result));  
}
```

## 4.8 执行 Gremlin 查询

您可以使用GES提供的接口执行Gremlin查询。示例代码如下：

### □ 说明

在graph client初始化时，已经在系统中生成与graph name同名的对象，用户直接用graph name进行查询即可。

```
public static void executeGremlinQuery(GraphClient graphClient, String graphName) throws ApiException
{
    //gremlin命令，graph client初始化时默认生成了与图名称同名的对象，如下直接使用即可
    String gremlinCommand = graphName + ".V(\"145\")";
    GremlinQueryReq req = new GremlinQueryReq();
    req.setCommand(gremlinCommand);
    Map<String, Object> stringObjectMap = graphClient.gremlinQuery(req);
    System.out.print(MapUtils.map2json(stringObjectMap));
}
```

## 4.9 执行算法

### 4.9.1 Page\_rank 算法

您可以使用GES提供的接口执行page\_rank算法。示例代码如下

```
public void static executeAlgorithm(GraphClient graphClient) throws ApiException
{
    //设置page_rank算法参数
    PageRankParameters parameters = new PageRankParameters();
    parameters.setMaxIterations(1000);
    //算法请求
    AlgorithmReq req = new AlgorithmReq();
    req.setAlgorithmName(AlgorithmNames.PAGE_RANK);
    req.setParameters(parameters);
    //执行算法
    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(req);
    //获取JobId
    String jobId = asyncAPIResp.getJobId();
    PageRankJobReq req1 = new PageRankJobReq();
    req1.setJobId(jobId);
    //根据JobId查询算法执行结果
    JobResp<QueryData<PageRankResult>> resp = graphClient.queryJobStatus(req1);
    System.out.println(resp);
}
```

### 4.9.2 Personal\_rank 算法

您可以使用GES提供的接口执行personal\_rank算法。示例代码如下

```
public static void executeAlgorithm(GraphClient graphClient) throws ApiException
{
    PersonalRankParameters parameters = new PersonalRankParameters();
    parameters.setMaxIterations(1000);
    parameters.setSource("46");
    AlgorithmReq req = new AlgorithmReq();
    req.setAlgorithmName(AlgorithmNames.PERSONAL_RANK);
    req.setParameters(parameters);
    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(req);
    String jobId = asyncAPIResp.getJobId();
    PersonalRankJobReq req1 = new PersonalRankJobReq();
    req1.setJobId(jobId);
    JobResp<QueryData<PersonalRankResult>> resp = graphClient.queryJobStatus(req1);
```

```
System.out.println(resp);  
}
```

### 4.9.3 k\_hop 算法

您可以使用GES提供的接口执行k\_hop算法。示例代码如下

```
public static void executeAlgorithm(GraphClient graphClient) throws ApiException  
{  
    KHopParameters parameters = new KHopParameters();  
    parameters.setSource("46");  
    parameters.setK(2);  
    parameters.setMode(EdgeDirection.OUT);  
    AlgorithmReq req = new AlgorithmReq();  
    req.setAlgorithmName(AlgorithmNames.K_HOP);  
    req.setParameters(parameters);  
  
    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(req);  
    String jobId = asyncAPIResp.getJobId();  
    KHopJobReq req1 = new KHopJobReq();  
    req1.setJobId(jobId);  
    System.out.println(graphClient.queryJobStatus(req1));  
}
```

### 4.9.4 K\_core 算法

您可以使用GES提供的接口执行k\_core算法。示例代码如下

```
public static void executeAlgorithm(GraphClient graphClient) throws ApiException  
{  
    KCoreParameters parameters = new KCoreParameters();  
    parameters.setK(3);  
  
    AlgorithmReq req = new AlgorithmReq();  
    req.setAlgorithmName(AlgorithmNames.K_CORE);  
    req.setParameters(parameters);  
  
    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(req);  
    String jobId = asyncAPIResp.getJobId();  
    KCoreJobReq req1 = new KCoreJobReq();  
    req1.setJobId(jobId);  
    System.out.println(graphClient.queryJobStatus(req1));  
}
```

### 4.9.5 Shortest\_path 算法

您可以使用GES提供的接口执行shortest\_path算法。示例代码如下

```
public static void executeAlgorithm(GraphClient graphClient) throws ApiException  
{  
    ShortestPathParameters parameters = new ShortestPathParameters();  
    parameters.setSource("30");  
    parameters.setTarget("46");  
  
    AlgorithmReq req = new AlgorithmReq();  
    req.setAlgorithmName(AlgorithmNames.SHORTEST_PATH);  
    req.setParameters(parameters);  
  
    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(req);  
    String jobId = asyncAPIResp.getJobId();  
    ShortestPathJobReq req1 = new ShortestPathJobReq();  
    req1.setJobId(jobId);  
    System.out.println(graphClient.queryJobStatus(req1));  
}
```

## 4.9.6 All\_shortest\_paths 算法

您可以使用GES提供的接口执行all\_shortest\_paths算法。示例代码如下

```
public static void executeAlgorithm(GraphClient graphClient) throws ApiException {
    AllShortestPathParameters parameters = new AllShortestPathParameters();
    parameters.setSource("46");
    parameters.setTarget("35");
    //算法请求
    AlgorithmReq req = new AlgorithmReq();
    //设置算法名称
    req.setAlgorithmName(AlgorithmNames.ALL_SHORTEST_PATHS);
    req.setParameters(parameters);
    //执行算法
    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(req);
    //获取 jobId
    String jobId = asyncAPIResp.getJobId();
    AllShortestPathJobReq req1 = new AllShortestPathJobReq();
    req1.setJobId(jobId);
    //根据 jobId 查询算法执行结果
    System.out.println(graphClient.queryJobStatus(req1));
}
```

## 4.9.7 filtered\_shortest\_path 算法

您可以使用GES提供的接口执行filtered\_shortest\_path算法。示例代码如下：

```
public void filteredShortestPath(GraphClient graphClient) throws ApiException {
    FilteredShortestPathParameters filteredShortestPathParameters = new FilteredShortestPathParameters();
    filteredShortestPathParameters.setSource("Vivian");
    filteredShortestPathParameters.setTarget("Mercedes");
    filteredShortestPathParameters.setDirected(false);

    AlgorithmReq algorithmReq = new AlgorithmReq();
    algorithmReq.setAlgorithmName(AlgorithmNames.FILTERED_SHORTEST_PATH); // 算法名
    algorithmReq.setParameters(filteredShortestPathParameters); // 算法参数

    // 根据输入参数执行指定算法
    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(algorithmReq);

    // 根据算法执行任务id，查询任务执行状态
    QueryJobReq queryJobReq = new QueryJobReq();
    queryJobReq.setJobId(asyncAPIResp.getJobId());
    GesResponse gesResponse = graphClient.queryAsyncTask(queryJobReq);
    System.out.println(gesResponse);
}
```

## 4.9.8 SSSP 算法

您可以使用GES提供的接口执行SSSP算法。示例代码如下：

```
public static void executeAlgorithm(GraphClient graphClient) throws ApiException {
    SSSPParameters parameters = new SSSPParameters();
    parameters.setSource("46");
    //算法请求
    AlgorithmReq req = new AlgorithmReq();
    //设置算法名称
    req.setAlgorithmName(AlgorithmNames.SSSP);
    req.setParameters(parameters);
    //执行算法
    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(req);
    //获取 jobId
    String jobId = asyncAPIResp.getJobId();
    SSSPJobReq req1 = new SSSPJobReq();
    req1.setJobId(jobId);
}
```

```
//根据JobId查询算法执行结果
System.out.println(graphClient.queryJobStatus(req1));
}
```

### 4.9.9 shortest\_path\_of\_vertex\_sets 算法

您可以使用GES提供的接口执行shortest\_path\_of\_vertex\_sets算法。示例代码如下：

```
public void shortestPathsOfVertexSets(GraphClient graphClient) throws ApiException {
    ShortestPathsOfVertexSetsParameters shortestPathsOfVertexSetsParameters = new
ShortestPathsOfVertexSetsParameters();
    shortestPathsOfVertexSetsParameters.setSources("Vivian,Mercedes");
    shortestPathsOfVertexSetsParameters.setTargets("Katherine");
    shortestPathsOfVertexSetsParameters.setDirected(false);

    AlgorithmReq algorithmReq = new AlgorithmReq();
    algorithmReq.setAlgorithmName(AlgorithmNames.SHORTEST_PATH_OF_VERTEX_SETS); // 算法名
    algorithmReq.setParameters(shortestPathsOfVertexSetsParameters); // 算法参数

    // 根据输入参数执行指定算法
    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(algorithmReq);

    // 根据算法执行任务id，查询任务执行状态
    QueryJobReq queryJobReq = new QueryJobReq();
    queryJobReq.setJobId(asyncAPIResp.getJobId());
    GesResponse gesResponse = graphClient.queryAsyncTask(queryJobReq);
    System.out.println(gesResponse);
}
```

### 4.9.10 n\_paths 算法

您可以使用GES提供的接口执行n\_paths算法。示例代码如下：

```
public void nPaths(GraphClient graphClient) throws ApiException {
    NPathsParameters nPathsParameters = new NPathsParameters();
    nPathsParameters.setSource("Vivian");
    nPathsParameters.setTarget("Katherine");
    nPathsParameters.setDirected(false);
    nPathsParameters.setN(10);
    nPathsParameters.setK(5);

    AlgorithmReq algorithmReq = new AlgorithmReq();
    algorithmReq.setAlgorithmName(AlgorithmNames.N_PATHS); // 算法名
    algorithmReq.setParameters(nPathsParameters); // 算法参数

    // 根据输入参数执行指定算法
    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(algorithmReq);

    // 根据算法执行任务id，查询任务执行状态
    QueryJobReq queryJobReq = new QueryJobReq();
    queryJobReq.setJobId(asyncAPIResp.getJobId());
    GesResponse gesResponse = graphClient.queryAsyncTask(queryJobReq);
    System.out.println(gesResponse);
}
```

### 4.9.11 Closeness 算法

您可以使用GES提供的接口执行closeness算法。示例代码如下

```
public static void executeAlgorithm(GraphClient graphClient) throws ApiException
{
    ClosenessCentralityParameters parameters = new ClosenessCentralityParameters();
    parameters.setSource("46");
    AlgorithmReq req = new AlgorithmReq();
    req.setAlgorithmName(AlgorithmNames.CLOSENESS);
    req.setParameters(parameters);
```

```
AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(req);
String jobId = asyncAPIResp.getJobId();
ClosenessJobReq req1 = new ClosenessJobReq();
req1.setJobId(jobId);
System.out.println(graphClient.queryJobStatus(req1));
}
```

## 4.9.12 Label\_propagation 算法

您可以使用GES提供的接口执行label\_propagation算法。示例代码如下

```
public static void executeAlgorithm(GraphClient graphClient) throws ApiException
{
    AlgorithmReq req = new AlgorithmReq();
    req.setAlgorithmName(AlgorithmNames.LABEL_PROPAGATION);

    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(req);
    String jobId = asyncAPIResp.getJobId();
    LabelPropagationJobReq req1 = new LabelPropagationJobReq();
    req1.setJobId(jobId);
    System.out.println(graphClient.queryJobStatus(req1));
}
```

## 4.9.13 Louvain 算法

您可以使用GES提供的接口执行Louvain算法。示例代码如下

```
public static void executeAlgorithm(GraphClient graphClient) throws ApiException
{
    AlgorithmReq req = new AlgorithmReq();
    req.setAlgorithmName(AlgorithmNames.LOUVAIN);

    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(req);
    String jobId = asyncAPIResp.getJobId();
    LouvainJobReq req1 = new LouvainJobReq();
    req1.setJobId(jobId);
    System.out.println(graphClient.queryJobStatus(req1));
}
```

## 4.9.14 Link\_prediction 算法

您可以使用GES提供的接口执行link\_prediction算法。示例代码如下

```
public static void executeAlgorithm(GraphClient graphClient) throws ApiException
{
    LinkPredictionParameters parameters = new LinkPredictionParameters();
    parameters.setSource("46");
    parameters.setTarget("38");
    AlgorithmReq req = new AlgorithmReq();
    req.setAlgorithmName(AlgorithmNamesLINK_PREDICTION);
    req.setParameters(parameters);
    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(req);
    String jobId = asyncAPIResp.getJobId();
    LinkPredictionJobReq req1 = new LinkPredictionJobReq();
    req1.setJobId(jobId);
    System.out.println(graphClient.queryJobStatus(req1));
}
```

## 4.9.15 Node2vec 算法

您可以使用GES提供的接口执行node2vec算法。示例代码如下：

```
public static void executeAlgorithm(GraphClient graphClient) throws ApiException
{
    AlgorithmReq req = new AlgorithmReq();
    req.setAlgorithmName(AlgorithmNames.NODE2VEC);
```

```
AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(req);
String jobId = asyncAPIResp.getJobId();
Node2VecReq req1 = new Node2VecReq();
req1.setJobId(jobId);
JobResp<QueryData<Node2VecResult>> resp = graphClient.queryJobStatus(req1);
while (!resp.getStatus().equals("success"))
{
    resp = graphClient.queryJobStatus(req1);
    Thread.sleep(2000);
}
System.out.println(resp)
}
```

## 4.9.16 Realtime\_recommendation 算法

您可以使用GES提供的接口执行realtime\_recommendation算法。示例代码如下

```
public static void executeAlgorithm(GraphClient graphClient) throws ApiException
{
    RealtimeRecParameters parameters = new RealtimeRecParameters();
    parameters.setSources("34,37,34");
    AlgorithmReq req = new AlgorithmReq();
    req.setAlgorithmName(AlgorithmNames.REALTIME_RECOMMENDATION);
    req.setParameters(parameters);

    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(req);
    String jobId = asyncAPIResp.getJobId();
    RealtimeRecommendationJobReq req1 = new RealtimeRecommendationJobReq();
    req1.setJobId(jobId);
    System.out.println(graphClient.queryJobStatus(req1));
}
```

## 4.9.17 Common\_neighbors 算法

您可以使用GES提供的接口执行common\_neighbors算法。示例代码如下

```
public static void executeAlgorithm(GraphClient graphClient) throws ApiException
{
    CommonNeighborsParameters parameters = new CommonNeighborsParameters();
    parameters.setSource("46");
    parameters.setTarget("38");
    AlgorithmReq req = new AlgorithmReq();
    req.setAlgorithmName(AlgorithmNames.COMMON_NEIGHBORS);
    req.setParameters(parameters);
    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(req);
    String jobId = asyncAPIResp.getJobId();
    CommonNeighborsJobReq req1 = new CommonNeighborsJobReq();
    req1.setJobId(jobId);
    System.out.println(graphClient.queryJobStatus(req1));
}
```

## 4.9.18 Connect\_component 算法

您可以使用GES提供的接口执行connect\_component算法。示例代码如下

```
public static void executeAlgorithm(GraphClient graphClient) throws ApiException
{
    AlgorithmReq req = new AlgorithmReq();
    req.setAlgorithmName(AlgorithmNames.CONNECTED_COMPONENT);

    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(req);
    String jobId = asyncAPIResp.getJobId();
    ConnectComponentJobReq req1 = new ConnectComponentJobReq();
    req1.setJobId(jobId);
    System.out.println(graphClient.queryJobStatus(req1));
}
```

## 4.9.19 Degree\_correlation 算法

您可以使用GES提供的接口执行degree\_correlation算法。示例代码如下

```
public static void executeAlgorithm(GraphClient graphClient) throws ApiException
{
    AlgorithmReq req = new AlgorithmReq();
    req.setAlgorithmName(AlgorithmNames.DEGREE_CORRELATION);
    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(req);
    String jobId = asyncAPIResp.getJobId();
    DegreeCorrelationJobReq req1 = new DegreeCorrelationJobReq();
    req1.setJobId(jobId);
    System.out.println(graphClient.queryJobStatus(req1));
}
```

## 4.9.20 Triangle\_count 算法

您可以使用GES提供的接口执行triangle\_count算法。示例代码如下

```
public static void executeAlgorithm(GraphClient graphClient) throws ApiException
{
    //算法请求
    AlgorithmReq req = new AlgorithmReq();
    req.setAlgorithmName(AlgorithmNames.TRIANGLE_COUNT);
    //执行算法
    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(req);
    //获取JobId
    String jobId = asyncAPIResp.getJobId();
    TriangleCountJobReq req1 = new TriangleCountJobReq();
    req1.setJobId(jobId);
    //根据JobId查询算法执行结果
    JobResp<QueryData<TriangleCountResult>> resp = graphClient.queryJobStatus(req1);
    System.out.println(resp);
}
```

## 4.9.21 Cluster\_coefficient 算法

您可以使用GES提供的接口执行cluster\_coefficient算法。示例代码如下

```
public static void executeAlgorithm(GraphClient graphClient) throws ApiException
{
    AlgorithmReq req = new AlgorithmReq();
    req.setAlgorithmName(AlgorithmNames.CLUSTER_COEFFICIENT);

    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(req);
    String jobId = asyncAPIResp.getJobId();
    ClusterCoefficientJobReq req1 = new ClusterCoefficientJobReq();
    req1.setJobId(jobId);
    System.out.println(graphClient.queryJobStatus(req1));
}
```

## 4.9.22 Filtered\_circle\_detection

您可以使用GES提供的接口执行filtered\_circle\_detection算法。示例代码如下：

```
public void filteredCircleDetection(GraphClient graphClient) throws ApiException {
    FilteredCircleDetectionParameters filteredCircleDetectionParameters = new
    FilteredCircleDetectionParameters();
    filteredCircleDetectionParameters.setSource("Vivian");
    filteredCircleDetectionParameters.setN(100);

    AlgorithmReq algorithmReq = new AlgorithmReq();
    algorithmReq.setAlgorithmName(AlgorithmNames.FILTERED_CIRCLE_DELETION); // 算法名
    algorithmReq.setParameters(filteredCircleDetectionParameters); // 算法参数
    algorithmReq.addFilter("out", FilterQueryType.EDGE_FILTER, "label_name", "labelName", "=", "transfer",
```

```

5);

// 根据输入参数执行指定算法
AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(algorithmReq);

// 根据算法执行任务id，查询任务执行状态
QueryJobReq queryJobReq = new QueryJobReq();
queryJobReq.setJobId(asyncAPIResp.getJobId());
GesResponse gesResponse = graphClient.queryAsyncTask(queryJobReq);
System.out.println(gesResponse);
}

```

### 4.9.23 subgraph\_matching 算法

您可以使用GES提供的接口执行subgraph\_matching算法。示例代码如下：

```

public void subgraphMatching(GraphClient graphClient) throws ApiException {
    SubgraphMatchingParameters subgraphMatchingParameters = new SubgraphMatchingParameters();
    subgraphMatchingParameters.setEdges("");
    subgraphMatchingParameters.setVertices("");

    AlgorithmReq algorithmReq = new AlgorithmReq();
    algorithmReq.setAlgorithmName(AlgorithmNames.SUBGRAPH_MATCHING); // 算法名
    algorithmReq.setParameters(subgraphMatchingParameters); // 算法参数

    // 根据输入参数执行指定算法
    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(algorithmReq);

    // 根据算法执行任务id，查询任务执行状态
    QueryJobReq queryJobReq = new QueryJobReq();
    queryJobReq.setJobId(asyncAPIResp.getJobId());
    GesResponse gesResponse = graphClient.queryAsyncTask(queryJobReq);
    System.out.println(gesResponse);
}

```

### 4.9.24 Filtered All Pairs Shortest paths 算法

您可以使用GES提供的接口执行Filtered All Pairs Shortest paths算法。示例代码如下：

```

public void filteredAllPairsShortestPaths(GraphClient graphClient) throws ApiException {
    FilteredAllPairsShortestPathsParameters filteredAllPairsShortestPathsParameters = new
    FilteredAllPairsShortestPathsParameters();
    filteredAllPairsShortestPathsParameters.setSources("Vivian");
    filteredAllPairsShortestPathsParameters.setTargets("Lethal Weapon");

    AlgorithmReq algorithmReq = new AlgorithmReq();
    algorithmReq.setAlgorithmName(AlgorithmNames.FILTERED_ALL_PAIRS_SHORTEST_PATHS); // 算法名
    algorithmReq.setParameters(filteredAllPairsShortestPathsParameters); // 算法参数

    // 根据输入参数执行指定算法
    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(algorithmReq);

    // 根据算法执行任务id，查询任务执行状态
    QueryJobReq queryJobReq = new QueryJobReq();
    queryJobReq.setJobId(asyncAPIResp.getJobId());
    GesResponse gesResponse = graphClient.queryAsyncTask(queryJobReq);
    System.out.println(gesResponse);
}

```

### 4.9.25 filtered\_all\_shortest\_paths 算法

您可以使用GES提供的接口执行filtered\_all\_shortest\_paths算法。示例代码如下：

```

public void filteredAllShortestPaths(GraphClient graphClient) throws ApiException {
    FilteredAllShortestPathsParameters filteredAllShortestPathsParameters = new
    FilteredAllShortestPathsParameters();

```

```

filteredAllShortestPathsParameters.setSource("Vivian");
filteredAllShortestPathsParameters.setTarget("Lethal Weapon");

AlgorithmReq algorithmReq = new AlgorithmReq();
algorithmReq.setAlgorithmName(AlgorithmNames.FILTERED_ALL_SHORTEST_PATHS); // 算法名
algorithmReq.setParameters(filteredAllShortestPathsParameters); // 算法参数

// 根据输入参数执行指定算法
AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(algorithmReq);

// 根据算法执行任务id，查询任务执行状态
QueryJobReq queryJobReq = new QueryJobReq();
queryJobReq.setJobId(asyncAPIResp.getJobId());
GesResponse gesResponse = graphClient.queryAsyncTask(queryJobReq);
System.out.println(gesResponse);
}

```

## 4.9.26 topicrank 算法

您可以使用GES提供的接口执行topicrank算法。示例代码如下：

```

public void topicrank(GraphClient graphClient) throws ApiException {
    TopicrankParameters topicrankParameters = new TopicrankParameters();
    topicrankParameters.setSources("Vivian");

    AlgorithmReq algorithmReq = new AlgorithmReq();
    algorithmReq.setAlgorithmName(AlgorithmNames.TOPICRANK); // 算法名
    algorithmReq.setParameters(topicrankParameters); // 算法参数

    // 根据输入参数执行指定算法
    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(algorithmReq);

    // 根据算法执行任务id，查询任务执行状态
    QueryJobReq queryJobReq = new QueryJobReq();
    queryJobReq.setJobId(asyncAPIResp.getJobId());
    GesResponse gesResponse = graphClient.queryAsyncTask(queryJobReq);
    System.out.println(gesResponse);
}

```

## 4.9.27 filtered\_n\_paths 算法

您可以使用GES提供的接口执行filtered\_n\_paths算法。示例代码如下：

```

public void filteredNPaths(GraphClient graphClient) throws ApiException {
    FilteredNPathsParameters filteredNPathsParameters = new FilteredNPathsParameters();
    filteredNPathsParameters.setSource("Vivian");
    filteredNPathsParameters.setTarget("Lethal Weapon");
    filteredNPathsParameters.setK(2);
    filteredNPathsParameters.setN(1);

    AlgorithmReq algorithmReq = new AlgorithmReq();
    algorithmReq.setAlgorithmName(AlgorithmNames.FILTERED_N_PATHS); // 算法名
    algorithmReq.setParameters(filteredNPathsParameters); // 算法参数
    algorithmReq.addFilter("out", FilterQueryType.EDGE_FILTER, "label_name", "labelName", "=", "transfer",
5);

    // 根据输入参数执行指定算法
    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(algorithmReq);

    // 根据算法执行任务id，查询任务执行状态
    QueryJobReq queryJobReq = new QueryJobReq();
    queryJobReq.setJobId(asyncAPIResp.getJobId());
    GesResponse gesResponse = graphClient.queryAsyncTask(queryJobReq);
    System.out.println(gesResponse);
}

```

## 4.9.28 common\_neighbors\_of\_vertex\_sets 算法

您可以使用GES提供的接口执行common\_neighbors\_of\_vertex\_sets算法。示例代码如下：

```
public void commonNeighborsOfVertexSets(GraphClient graphClient) throws ApiException {
    CommonNeighborsOfVertexSetsParameters commonNeighborsOfVertexSetsParameters = new
    CommonNeighborsOfVertexSetsParameters();
    commonNeighborsOfVertexSetsParameters.setSources("Vivian");
    commonNeighborsOfVertexSetsParameters.setTargets("Katherine");

    AlgorithmReq algorithmReq = new AlgorithmReq();
    algorithmReq.setAlgorithmName(AlgorithmNames.COMMON_NEIGHBORS_OF_VERTEX_SETS); // 算法名
    algorithmReq.setParameters(commonNeighborsOfVertexSetsParameters); // 算法参数

    // 根据输入参数执行指定算法
    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(algorithmReq);

    // 根据算法执行任务id，查询任务执行状态
    QueryJobReq queryJobReq = new QueryJobReq();
    queryJobReq.setJobId(asyncAPIResp.getJobId());
    GesResponse gesResponse = graphClient.queryAsyncTask(queryJobReq);
    System.out.println(gesResponse);
}
```

## 4.9.29 all\_shortest\_paths\_of\_vertex\_sets 算法

您可以使用GES提供的接口执行all\_shortest\_paths\_of\_vertex\_sets算法。示例代码如下：

```
public void allShortestPathsOfVertexSets(GraphClient graphClient) throws ApiException {
    AllShortestPathsOfVertexSetsParameters allShortestPathsOfVertexSetsParameters = new
    AllShortestPathsOfVertexSetsParameters();
    allShortestPathsOfVertexSetsParameters.setSources("Vivian");
    allShortestPathsOfVertexSetsParameters.setTargets("Katherine");

    AlgorithmReq algorithmReq = new AlgorithmReq();
    algorithmReq.setAlgorithmName(AlgorithmNames.ALL_SHORTEST_PATH_OF_VERTEX_SETS); // 算法名
    algorithmReq.setParameters(allShortestPathsOfVertexSetsParameters); // 算法参数

    // 根据输入参数执行指定算法
    AsyncAPIResp asyncAPIResp = graphClient.algorithmQuery(algorithmReq);

    // 根据算法执行任务id，查询任务执行状态
    QueryJobReq queryJobReq = new QueryJobReq();
    queryJobReq.setJobId(asyncAPIResp.getJobId());
    GesResponse gesResponse = graphClient.queryAsyncTask(queryJobReq);
    System.out.println(gesResponse);
}
```

## 4.10 查询 Job 状态

您可以使用GES提供的接口查询Job状态。示例代码如下：

```
public static void queryAsyncTask(GraphClient graphClient, String jobId) throws ApiException {
    VertexQueryJobReq req = new VertexQueryJobReq();
    //设置分页查询参数，offset默认为0，limit默认为100000
    req.setOffset(0);
    req.setLimit(100);
    req.setJobId(jobId);
    JobResp<QueryData<VertexQueryResult>> resp = graphClient.queryJobStatus(req);
    System.out.println(resp);
}
```

### 📖 说明

对过滤查询、边过滤查询、执行算法等异步API，命令下发后，会返回jobId，可以通过jobId查询任务的执行状态。

## 4.11 取消 Job

您可以使用GES提供的接口取消Job。示例代码如下：

```
public static void stopAsyncJob(GraphClient graphClient, String jobId) throws ApiException
{
    Map result = graphClient.deleteJob(jobId);
    //用MapUtils工具类格式化输出
    System.out.print(MapUtils.map2json(result));
}
```

### 📖 说明

过滤查询、边过滤查询、执行算法等异步API，命令下发后，会返回jobId，可以通过jobId终止该任务。

## 4.12 添加点

您可以使用GES提供的接口添加点。示例代码如下：

```
public static void addVertex(GraphClient graphClient) throws ApiException
{
    Map properties = new HashMap();
    List gender = new ArrayList();
    gender.add("F");
    properties.put("Gender", gender);
    List occupation = new ArrayList();
    occupation.add("artist");
    properties.put("Occupation", occupation);
    List age = new ArrayList();
    age.add("under 18");
    properties.put("Age", age);
    List zipCode = new ArrayList();
    zipCode.add("98133");
    properties.put("Zip-code", zipCode);
    AddVertexReq req = new AddVertexReq();
    //设置vertex Id
    req.setVertexId("Lily");
    //设置label
    req.setLabel("user");
    //设置属性
    req.setProperties(properties);
    graphClient.addVertex(req);
}
```

## 4.13 删除点

您可以使用GES提供的接口删除点。示例代码如下：

```
public static void deleteVertex(GraphClient graphClient) throws ApiException
{
    String vertexId = "Lily"
    graphClient.deleteVertex(vertexId);
}
```

## 4.14 添加边

您可以使用GES提供的接口添加边。示例代码如下：

```
public static void addEdge(GraphClient graphClient) throws ApiException
{
    AddEdgeReq req = new AddEdgeReq();
    req.setSource("Lily");
    req.setTarget("Rocky");
    req.setLabel("rate");
    Map properties = new HashMap();
    List score = new ArrayList();
    score.add("5");
    properties.put("Score", score);
    List datetime = new ArrayList();
    datetime.add("2018-01-01 20:30:05");
    properties.put("Datetime", datetime);
    req.setProperties(properties);
    graphClient.addEdge(req);
}
```

## 4.15 删边

您可以使用GES提供的接口删除边。示例代码如下：

```
public static void deleteEdge(GraphClient graphClient) throws ApiException
{
    DeleteEdgeReq deleteEdgeReq = new DeleteEdgeReq();
    deleteEdgeReq.setSource("Lily");
    deleteEdgeReq.setTarget("Rocky");
    deleteEdgeReq.setIndex(0);
    graphClient.deleteEdge(deleteEdgeReq);
}
```

## 4.16 添加索引

您可以使用GES提供的接口添加索引。示例代码如下：

```
public void excuteCreateIndex(GraphClient graphClient) throws ApiException
{
    CreateIndexReq req = new CreateIndexReq();
    //表示是否有label，不区分大小写，不填时默认为false
    req.setHasLabel("true");
    //索引名称，只能包含字母或数字不能包含特殊字符，无默认值
    req.setIndexName("ageIndex");
    //元素类型，可选值有“vertex”或“edge”，不区分大小写，无默认值
    req.setElementType("vertex");
    //索引类型，可选“GlobalCompositeVertexIndex”或“GlobalCompositeEdgeIndex”，区分大小写，无默认值
    req.setIndexType("GlobalCompositeVertexIndex");
    //索引的属性列表（支持的属性类型有：int, float, double, long, enum, char array, string, date）
    //若hasLabel为false或null，则该项为必选
    req.setIndexProperty(req.setIndexProperty(new String[] {"age"}));
    Map<String, Object> result = graphClient.createIndex(req);
    System.out.print(MapUtils.map2json(result));
}
```

## 4.17 删除索引

您可以使用GES提供的接口删除索引。示例代码如下：

```
public void excuteDeleteIndex(GraphClient graphClient) throws ApiException, GraphSdkException
{
    //删除indexName为ageIndex的索引
    Map<String, Object> result = graphClient.deleteIndex("ageIndex");
    System.out.print(MapUtils.map2json(result));
}
```

## 4.18 查询索引

您可以使用GES提供的接口查询索引。示例代码如下：

```
public void excuteQueryIndex(GraphClient graphClient) throws ApiException
{
    //查询该图上的所有索引
    QueryIndexResult result = graphClient.queryIndex();
    System.out.print(result);
}
```

## 4.19 导出图

您可以使用GES提供的接口导出图的数据。示例代码如下：

```
public static void exportGraph(GraphClient graphClient) throws ApiException
{
    ExportGraphReq exportGraphReq = new ExportGraphReq();
    exportGraphReq.setGraphName(graphInfo.getGraphName());
    exportGraphReq.setEdgeSetName("movie-edge.csv");
    exportGraphReq.setVertexSetName("movie-vertex.csv");
    exportGraphReq.setSchemaName("movie-schema.csv");
    exportGraphReq.setGraphExportPath("imagebucket/movie/");
    ObsParameters obsParameters = new ObsParameters();
    obsParameters.setAccessKey("****");
    obsParameters.setSecretKey("****");
    obsParameters.setRegion("cn-hk1");
    exportGraphReq.setObsParameters(obsParameters);
    graphClient.exportGraph(exportGraphReq);
}
```

## 4.20 清除图

您可以使用GES提供的接口清除图的数据。示例代码如下：

```
public static void clearGraph(GraphClient graphClient) throws ApiException {
    ClearGraphReq clearGraphReq = new ClearGraphReq();
    clearGraphReq.setGraphName(graphInfo.getGraphName());
    graphClient.clearGraph(clearGraphReq);
}
```

## 4.21 添加 Property

您可以使用GES提供的接口添加Property。示例代码如下：

```
public static void addProperties(GraphClient graphClient) throws ApiException
{
    AddPropertiesReq req = new AddPropertiesReq();
```

```
req.setLabelName("stop");
List<Property> properties = new ArrayList<Property>();
Property property = new Property();
property.put("name", "a");
property.put("cardinality", "single");
property.put("dataType", "int");
properties.add(property);
req.setProperties(properties);
Map<String, Object> result = graphClient.addProperties(req);
System.out.println(MapUtils.map2json(result));
}
```

## 4.22 查询路径详情

您可以使用GES提供的接口查询路径详情。示例代码如下：

```
public static void getPathDetail(GraphClient graphClient) throws ApiException
{
    PathDetailReq pathDetailReq = new PathDetailReq();
    pathDetailReq.setDirected(true);
    List<List<String>> paths = new ArrayList();
    List<String> path1 = new ArrayList();
    path1.add("38");
    path1.add("0");
    List<String> path2 = new ArrayList();
    path2.add("35");
    path2.add("40");
    paths.add(path1);
    paths.add(path2);
    pathDetailReq.setPaths(paths);
    Map<String, Object> result = graphClient.getPathDetail(pathDetailReq);
    System.out.println(MapUtils.map2json(result));
}
```

## 4.23 增量导入图

您可以使用GES提供的接口增量导入图。示例代码如下：

```
public static void incrementImport(GraphClient graphClient) throws ApiException
{
    ImportGraphReq importGraphReq = new ImportGraphReq();
    importGraphReq.setGraphName(graphName);
    importGraphReq.setEdgesetPath("/home/lh/movie/ranking_edge.csv");
    importGraphReq.setEdgesetFormat("csv");
    importGraphReq.setVerticesetPath("/home/lh/movie/movies_vertex.csv");
    importGraphReq.setVerticesetFormat("csv_prop");
    ObsParameters obsParameters = new ObsParameters();
    obsParameters.setAccessKey("EW39NCDEXJ4E1JTNP2PCP");
    obsParameters.setSecretKey("rhsS0TP89ldNnDe6dug1iraEbQUeNZlbJ3QGgW5D");
    obsParameters.setRegion("southchina");
    importGraphReq.setObsParameters(obsParameters);
    // 执行导入图
    AsyncAPIResp res = graphClient.incrementImport(importGraphReq);
    // 获取JobId
    String jobId = res.getJobId();
    ImportGraphJobReq req = new ImportGraphJobReq();
    req.setJobId(jobId);
    // 根据JobId查询导图结果
    System.out.println(graphClient.queryJobStatus(req));
}
```

## 4.24 批量添加点

您可以使用GES提供的接口批量添加点。示例代码如下：

```

public static void addBatchVertice(GraphClient graphClient) throws ApiException
{
    // 构造点属性列表
    Map<String, List<Object>> properties = new HashMap<>();
    properties.put("movieid", Arrays.asList("180"));
    properties.put("title", Arrays.asList("testmoive"));
    properties.put("genres", Arrays.asList("Comedy"));

    // 构造单个点信息
    AddVertexReq vertex = new AddVertexReq();
    vertex.setVertexId("180");
    vertex.setLabel("movie");
    vertex.setProperties(properties);

    // 组成批量点信息
    List<AddVertexReq> vertices = new ArrayList<>();
    vertices.add(vertex);

    // 构造添加批量点请求
    AddBatchVertexReq addBatchVertexReq = new AddBatchVertexReq();
    addBatchVertexReq.setVertices(vertices);

    // 执行添加批量点请求
    Map<String, Object> result = graphClient.addBatchVertex(addBatchVertexReq);
}

```

## 4.25 批量删除点

您可以使用GES提供的接口批量删除点。示例代码如下：

```

public static void deleteBatchVertice(GraphClient graphClient) throws ApiException
{
    String movieVertex = "2";
    String userVertex = "100";

    // 构造待删除点id列表
    List<String> vertices = new ArrayList<>();
    vertices.add(movieVertex);
    vertices.add(userVertex);

    // 构造批量删除点请求
    DeleteBatchVertexReq deleteBatchVertexReq = new DeleteBatchVertexReq();
    deleteBatchVertexReq.setVertices(vertices);

    // 执行批量删除点
    Map<String, Object> result = graphClient.deleteBatchVertex(deleteBatchVertexReq);
}

```

## 4.26 批量添加边

您可以使用GES提供的接口批量添加边。示例代码如下：

```

public static void addBatchEdges(GraphClient graphClient) throws ApiException
{
    // 构造边信息
    Edge edge = new Edge();
    edge.setSource("46");
    edge.setTarget("38");
    edge.setLabel("rate");
    Map<String, List<Object>> properties = new HashMap<>();
    properties.put("Rating", Arrays.asList("5"));
    properties.put("Datetime", Arrays.asList("2018-01-01 20:30:05"));
    edge.setProperties(properties);

    // 组成边列表
    List<Edge> edges = new ArrayList<>();
    edges.add(edge);
}

```

```
// 默认选项为允许重复边
ParallelEdgeOption parallelEdgeOption = new ParallelEdgeOption();

// 构造添加批量边请求
AddBatchEdgeReq addBatchEdgeReq = new AddBatchEdgeReq();
addBatchEdgeReq.setEdges(edges);
addBatchEdgeReq.setParallelEdge(parallelEdgeOption);

// 执行添加批量边请求
Map<String, Object> result = graphClient.addBatchEdge(addBatchEdgeReq);
}
```

## 4.27 批量删除边

您可以使用GES提供的接口批量删除边。示例代码如下：

```
public static void deleteBatchEdges(GraphClient graphClient) throws ApiException
{
    // 构造单条边信息
    DeleteEdgeReq edge = new DeleteEdgeReq();
    edge.setSource("46");
    edge.setTarget("39");

    DeleteEdgeReq edgeWithIndex = new DeleteEdgeReq();
    edgeWithIndex.setSource("46");
    edgeWithIndex.setTarget("38");
    edgeWithIndex.setIndex("8");

    // 组成待删除边列表
    List<DeleteEdgeReq> edges = new ArrayList<>();
    edges.add(edge);
    edges.add(edgeWithIndex);

    // 构造删除批量边请求
    DeleteBatchEdgeReq deleteBatchEdgeReq = new DeleteBatchEdgeReq();
    deleteBatchEdgeReq.setEdges(edges);

    // 执行删除批量边请求
    Map<String, Object> result = graphClient.deleteBatchEdge(deleteBatchEdgeReq);
}
```

## 4.28 批量更新点属性

您可以使用GES提供的接口批量更新点属性。示例代码如下：

```
public static void updateBatchVertice(GraphClient graphClient) throws ApiException
{
    // 构造单个点属性信息
    Map<String, List<Object>> properties = new HashMap<>();
    properties.put("年龄", Arrays.asList(20));
    AddVertexReq vertex = new AddVertexReq();
    vertex.setVertexId("张三1");
    vertex.setProperties(properties);

    Map<String, List<Object>> listProperties = new HashMap<>();
    listProperties.put("名称", Arrays.asList("测试", "数学"));
    AddVertexReq vertexWithListProperty = new AddVertexReq();
    vertexWithListProperty.setVertexId("张三0");
    vertexWithListProperty.setProperties(listProperties);

    Map<String, List<Object>> setProperties = new HashMap<>();
    setProperties.put("name", Arrays.asList("a", "d"));
    AddVertexReq vertexWithSetProperty = new AddVertexReq();
    vertexWithSetProperty.setVertexId("张三140");
    vertexWithSetProperty.setProperties(setProperties);
}
```

```
// 组成批量点属性信息
List<AddVertexReq> vertices = new ArrayList<>();
vertices.add(vertex);
vertices.add(vertexWithListProperty);
vertices.add(vertexWithSetProperty);

// 构造更新批量点属性请求
AddBatchVertexReq updateBatchVertexReq = new AddBatchVertexReq();
updateBatchVertexReq.setVertices(vertices);

// 执行更新批量点属性请求
Map<String, Object> result = graphClient.updateBatchVertex("batch-update", updateBatchVertexReq);
}
```

## 4.29 批量更新边属性

您可以使用GES提供的接口批量更新边属性。示例代码如下：

```
public static void updateBatchEdges(GraphClient graphClient) throws ApiException
{
    // 构造边信息，不指定index
    EdgeWithIndex edgeWithoutIndex = new EdgeWithIndex();
    edgeWithoutIndex.setSource("46");
    edgeWithoutIndex.setTarget("37");
    edgeWithoutIndex.setLabel("rate");
    Map<String, List<Object>> properties = new HashMap<>();
    properties.put("Rating", Arrays.asList("5"));
    properties.put("Datetime", Arrays.asList("2020-01-0120:30:05"));
    edgeWithoutIndex.setProperties(properties);

    // 构造边信息，指定index
    EdgeWithIndex edgeWithIndex = new EdgeWithIndex();
    edgeWithIndex.setSource("46");
    edgeWithIndex.setTarget("38");
    edgeWithIndex.setIndex("0");
    edgeWithIndex.setProperties(properties);

    // 组成边列表
    List<EdgeWithIndex> edges = new ArrayList<>();
    edges.add(edgeWithoutIndex);
    edges.add(edgeWithIndex);

    // 构造更新批量边属性请求
    UpdateBatchEdgePropertyReq updateBatchEdgeReq = new UpdateBatchEdgePropertyReq();
    updateBatchEdgeReq.setEdges(edges);

    // 执行更新批量边属性请求
    Map<String, Object> result = graphClient.updateBatchEdge("batch-update", updateBatchEdgeReq);
}
```

# 5 使用管理面 SDK

## 5.1 初始化 GES 管理面客户端

使用GES SDK工具访问GES管理面，需要用户初始化GES客户端。用户可以使用AK/SK(Access Key ID/Secret Access Key)或Token两种认证方式初始化客户端，示例代码如下：

- AK/SK认证方式样例代码

```
String ak = "ak";
String sk = "sk";
String regionName = "regionname";
String projectId = "project_id";
GesInfo gesInfo = new GesInfo(regionName, ak, sk, projectId);
GesClient client = new GesClient(AuthenticationMode.AKSK, gesInfo);
```

- Token认证方式样例代码

```
String domainName = "domainname";
String userName = "username";
String password = "password";
String regionName = "regionname";
String projectId = "project_id";
GesInfo gesInfo = new GesInfo(regionName, domainName, userName, password, projectId);
GesClient client = new GesClient(AuthenticationMode.TOKEN, gesInfo);
```

## 5.2 查询配额

GES提供查询配额接口，您可以使用该接口查询当前租户的配额，包括图配额和图备份配额。示例代码如下：

```
private static void getQuotas(GesClient client) throws GesSdkException{
    Quotas quotas = client.getQuotas();
    System.out.println(quotas);
}
```

## 5.3 校验元数据文件

GES提供校验元数据文件接口，您可以使用该接口校验选择的数据集和元数据文件是否匹配。示例代码如下：

```
private static void checkSchema(GesClient client) throws GesSdkException {
    Schema schema = new Schema();
```

```
schema.setSchemaPath("gesdata/movie/schema.xml");
schema.setEdgesetPath("gesdata/movie/edge.csv");
schema.setVertexsetPath("gesdata/movie/vertex.csv");
boolean checkResult = client.checkSchema(schema);
System.out.println(checkResult);

}
```

## 5.4 查询图列表

您可以使用GES提供的接口查询图列表，示例代码如下：

```
private static void listGraphs(GesClient client) throws GesSdkException {
    GraphList graphList = client.listGraphs();
    for (Graph graph : graphList.getGraphs())
    {
        System.out.println(graph);
    }
}
```

## 5.5 查询图详情

您可以使用GES提供的接口查询图详情，示例代码如下：

```
private static void getGraphDetail(GesClient client, String graphId) throws GesSdkException {
    GraphDetail graphDetail = client.queryGraphById(graphId);
    System.out.println(graphDetail);
}
```

## 5.6 创建图

您可以使用GES提供的接口创建一个图。示例代码如下：

```
private static void createGraph(GesClient client) throws GesSdkException {
    GraphReq graphReq = new GraphReq();
    graphReq.setName("ges0211");
    graphReq.setRegionCode("cn-north-1");
    graphReq.setAzCode("cn-north-1a");
    graphReq.setGraphSizeTypeIndex(1);
    graphReq.setSchemaPath("gesdata/movie/schema.xml");
    graphReq.setVertexsetPath("gesdata/movie/vertex.csv");
    graphReq.setEdgesetPath("gesdata/movie/edge.csv");
    graphReq.setEdgesetFormat("csv");
    graphReq.setVpcId("98a8900c-bd4c-4a29-a488-93f4b71378fb");
    graphReq.setSubnetId("b491203a-bcb7-4e0f-88e2-cdab3a636eef");
    graphReq.setSecurityGroupId("cefb75f5-fc97-4c82-a613-42d55299bd12");
    CreateGraphReq createGraphReq = new CreateGraphReq();
    createGraphReq.setGraph(graphReq);
    Graph graph = client.createGraph(createGraphReq);
    System.out.println(graph);
}
```

## 5.7 关闭图

您可以使用GES提供的接口关闭一个图。示例代码如下：

```
private static void stopGraph(GesClient client, String graphId) throws GesSdkException
{
    Job job = client.stopGraph(graphId);
    System.out.println(job);
}
```

## 5.8 启动图

您可以使用GES提供的接口启动一个图，可以从原图启动或者从某个备份ID启动。示例代码如下：

```
//从原图启动
private static void startGraph(GesClient client, String graphId) throws GesSdkException
{
    Job job = client.startGraph(graphId);
    System.out.println(job);
}

//从备份启动
private static void startGraphFromBackup(GesClient client, String graphId, String backUpId) throws
GesSdkException
{
    Job job = client.startGraph(graphId,backUpId);
    System.out.println(job);
}
```

## 5.9 删除图

您可以使用GES提供的接口删除一个图。示例代码如下：

```
private static void deleteGraph(GesClient client, String graphId) throws GesSdkException
{
    Job job = client.deleteGraph(graphId);
    System.out.println(job);
}
```

## 5.10 增量导入图

您可以使用GES提供的接口增量导入图。示例代码如下：

```
public static void incrementImport(GraphClient graphClient) throws ApiException
{
    ImportGraphReq importGraphReq = new ImportGraphReq();
    importGraphReq.setGraphName(graphName);
    importGraphReq.setEdgesetPath("/home/lh/movie/ranking_edge.csv");
    importGraphReq.setEdgesetFormat("csv");
    importGraphReq.setVerticesetPath("/home/lh/movie/movies_vertex.csv");
    importGraphReq.setVerticesetFormat("csv_prop");
    ObsParameters obsParameters = new ObsParameters();
    obsParameters.setAccessKey("EW39NCDEXJ4E1JTNP2PCP");
    obsParameters.setSecretKey("rhsS0TP89ldNnDe6dug1iraEbQUeNZlbJ3QGgW5D");
    obsParameters.setRegion("southchina");
    importGraphReq.setObsParameters(obsParameters);
    // 执行导入图
    AsyncAPIResp res = graphClient.incrementImport(importGraphReq);
    // 获取JobId
    String jobId = res.getJobId();
    ImportGraphJobReq req = new ImportGraphJobReq();
    req.setJobId(jobId);
    // 根据JobId查询导图结果
    System.out.println(graphClient.queryJobStatus(req));
}
```

## 5.11 导出图

您可以使用GES提供的接口导出图的数据。示例代码如下：

```
public static void exportGraph(GraphClient graphClient) throws ApiException {
{
    ExportGraphReq exportGraphReq = new ExportGraphReq();
    exportGraphReq.setGraphName(graphInfo.getGraphName());
    exportGraphReq.setEdgeSetName("movie-edge.csv");
    exportGraphReq.setVertexSetName("movie-vertex.csv");
    exportGraphReq.setSchemaName("movie-schema.csv");
    exportGraphReq.setGraphExportPath("imagebucket/movie/");
    ObsParameters obsParameters = new ObsParameters();
    obsParameters.setAccessKey("****");
    obsParameters.setSecretKey("****");
    obsParameters.setRegion("cn-hk1");
    exportGraphReq.setObsParameters(obsParameters);
    graphClient.exportGraph(exportGraphReq);
}
```

## 5.12 清空图

您可以使用GES提供的接口清除图的数据。示例代码如下：

```
public static void clearGraph(GraphClient graphClient) throws ApiException {
    ClearGraphReq clearGraphReq = new ClearGraphReq();
    clearGraphReq.setGraphName(graphInfo.getGraphName());
    graphClient.clearGraph(clearGraphReq);
}
```

## 5.13 升级图

您可以使用GES提供的接口升级一个图。示例代码如下：

```
public void upgradeGraph() throws Exception {
    UpgradeGraphReq upgradeGraphReq = new UpgradeGraphReq();
    Status status = client.upgradeGraph(graphId);
    System.out.println(status);
}
```

## 5.14 绑定 EIP

您可以使用GES提供的接口将EIP绑定到一个图上。示例代码如下：

```
public void testBindEip() throws Exception {
    BindEipReq bindEipReq = new BindEipReq();
    Status status = client.bindEip(graphId, bindEipReq);
    System.out.println(status);
}
```

## 5.15 解绑 EIP

您可以使用GES提供的接口将一个图绑定的EIP解绑。示例代码如下：

```
public void testUnbindEip() throws Exception {
    UnBindEipReq unBindEipReq = new UnBindEipReq();
    Status status = client.unbindEip(graphId, unBindEipReq);
    System.out.println(status);
}
```

## 5.16 查询所有备份列表

您可以使用GES提供的接口查询当前租户所有图的备份列表。示例代码如下：

```
private static void listBackups(GesClient client) throws GesSdkException
{
    GesBackUpList gesBackUpList = client.queryBackups();
    if (null == gesBackUpList.getBackupList())
    {
        System.out.println("backup is null");
    }
    else
    {
        for(GesBackUp backUp: gesBackUpList.getBackupList())
        {
            System.out.println(backUp);
        }
    }
}
```

## 5.17 查询某个图的备份列表

您可以使用GES提供的接口查询当前租户某个图的备份列表。示例代码如下：

```
private static void listBackupsByGraphId(GesClient client, String graphId) throws GesSdkException
{
    GesBackUpList gesBackUpList = client.queryBackupByld(graphId);
    if (null == gesBackUpList.getBackupList())
    {
        System.out.println("backup is null");
    }
    else
    {
        for(GesBackUp backUp: gesBackUpList.getBackupList())
        {
            System.out.println(backUp);
        }
    }
}
```

## 5.18 新增备份

您可以使用GES提供的接口新增图备份。示例代码如下：

```
private static void createBackup(GesClient client, String graphId) throws GesSdkException
{
    Job job = client.addBackup(graphId);
    System.out.println(job);
}
```

## 5.19 删除备份

您可以使用GES提供的接口将删除图备份。示例代码如下：

```
private static void deleteBackup(GesClient client, String graphId, String backupId) throws GesSdkException
{
    boolean b = client.deleteBackup(graphId, backupId);
    System.out.println(b);
}
```

## 5.20 查询 Job 状态

您可以使用GES提供的接口查询Job状态。示例代码如下：

```
private static void getJobStatus(GesClient client, String graphId, String jobId) throws GesSdkException
{
```

```
    JobResp jobsResp = client.queryJobStats(graphId, jobId);
    System.out.println(jobsResp);
}
```

#### □□ 说明

对停止图、启动图、恢复图、删除图、创建备份等异步API，命令下发后，会返回jobId，可以通过jobId查询任务的执行状态。

## 5.21 查询任务中心

您可以使用GES提供的接口查询任务中心。示例代码如下：

```
private static void queryJobs(GesClient client) throws GesSdkException
{
    JobsResp jobResp = client.queryJobs();
    System.out.println(jobResp);
}
```

#### □□ 说明

对停止图、启动图、恢复图、删除图、创建备份等异步API，命令下发后，会返回jobId，可以通过jobId查询任务的执行状态。

# 6 使用 Cypher JDBC Driver 访问 GES

## 功能介绍

GES Cypher JDBC Driver是专为GES编写的JDBC驱动，基于Neo4j JDBC Driver中的接口，提供了使用JDBC访问GES并进行cypher查询的一种方法。

尤其是当cypher请求返回数据量较大、并发数高、JVM缓存完整请求体有困难的场景下，该组件内置了一种可以流式解析响应body体的方法，与获得整个body体再解析相比，极大地降低了cpu和内存的占用。

## 依赖配置

使用前需进行工程导入，并配置maven工程，pom依赖配置如下：

```
<dependency>
    <groupId>com.huawei.ges</groupId>
    <artifactId>cypher-jdbc-driver</artifactId>
    <version>1.1.0</version>
</dependency>
```

## 使用参数

表 6-1 JDBC getConnection 参数说明

参数	释义
url	GES Cypher API的URL，添加前缀jdbc:ges:http(s)为前缀以方便JDBC Driver识别，是DriverManager.getConnection的第一个参数。
prop	Properties对象，包含连接GES API所需的各项配置，详见 <a href="#">表6-2</a> 。

表 6-2 Properties 参数信息

参数	释义
X-Auth-Token	通过iam鉴权接口获取到的token。

parse-json	是否转换点边对象，默认值为"false"，取值为false时，cypher返回体中的点和边将以map形式返回，为true时，以GesElement对象的形式返回。
------------	---

## 使用示例

```

package org.example;

import java.sql.DriverManager;
import java.sql.SQLException;
import java.sql.Connection;
import java.sql.PreparedStatement;
import java.sql.ResultSet;
import java.util.Properties;

public class App
{
    static String ip = "${ip}";
    static int port = 80;
    static String projectId = "${projectId}";
    static String graphName = "${graphName}";
    static String token = "${x_auth_token}";
    public static void main(String[] args) throws ClassNotFoundException, IllegalAccessException,
InstantiationException {
        Class.forName("com.huawei.ges.jdbc.Driver").newInstance();
        String url = "jdbc:ges:http://{{graph_ip}}:{{graph_port}}/ges/v1.0/{{project_id}}/graphs/{{graph_name}}/action?action_id=execute-cypher-query";
        url = url.replace("{{graph_ip}}", ip).replace("{{graph_port}}", port + "").replace("{{project_id}}",
projectId).replace("{{graph_name}}", graphName);
        Properties prop = new Properties();
        prop.setProperty("X-Auth-Token", token);
        prop.setProperty("deserializer-type", "lazy");
        prop.setProperty("parse-json", "true");
        prop.setProperty("limit", "10000");
        try(Connection conn = DriverManager.getConnection(url,prop)){
            String query = "match (m) return m limit 1000";
            try(PreparedStatement stmt = conn.prepareStatement(query)){
                try(ResultSet rs = stmt.executeQuery()){
                    Object o = null;
                    while(rs.next()) {
                        o = rs.getObject("m");
                        processVertex(o);
                    }
                }
            } catch (SQLException e) {
                // here process exception.
                // ...
            }
        }
    }
}

```

## 鉴权方法

GES Cypher JDBC Driver支持Token和AK/SK两种鉴权模式。

- Token鉴权相关参数详见[使用参数](#)和[使用示例](#)。
- AKSK鉴权需要依赖GES业务面SDK获取AK/SK签名后，使用签名进行鉴权操作。  
导入业务面SDK依赖详见[工程导入](#)，GraphInfo的配置详见[初始化GES业务面客户端](#)，并且需要您输入获取到的AccessKey，secretKey和regionName参数。

以AK/SK鉴权方式为例，代码示例如下：

```
import com.huawei.ges.jdbc.io.model.GesElement;
import com.huawei.graph.sdk.GraphInfo;
import com.huawei.graph.sdk.exception.GraphSdkException;
import com.huawei.graph.sdk.utils.HttpRestClient;
import org.slf4j.Logger;
import org.slf4j.LoggerFactory;

import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.PreparedStatement;
import java.sql.ResultSet;
import java.sql.SQLException;
import java.util.Properties;
import java.util.Map;

public class CypherJDBCClientByAKSK {

    private static final Logger logger = LoggerFactory.getLogger("CypherJDBCClientByAKSK");
    private static String ip = "";
    private static int port = 80;
    private static String projectId = "";
    private static String graphName = "";
    String accessKey = "here is access key";
    String secretKey = "here is secret key";
    String regionName = "cn-north-4";
    public static GraphInfo getGraphInfo() {
        //正式代码应该通过正常方式初始化graphInfo对象。
        GraphInfo info = getGraphInfoByYourself();
        // 此处需要输出您的AK/SK信息
        info.setAccessKey(accessKey);
        info.setSecretKey(secretKey);
        // 此处需要输出您的regionName
        info.setRegionName(regionName);
        return info;
    }

    public static void main(String[] args) throws ClassNotFoundException, IllegalAccessException, InstantiationException, GraphSdkException {
        GraphInfo info = getGraphInfo();

        Map<String, String> iamHeader = HttpRestClient.getIamSignHeaders(info);
        Class.forName("com.huawei.ges.jdbc.Driver").newInstance();
        String url = "jdbc:ges:http://{{graph_ip}}:{{graph_port}}/ges/v1.0/{{project_id}}/graphs/{{graph_name}}/action?action_id=execute-cypher-query";
        url = url.replace("{{graph_ip}}", ip).replace("{{graph_port}}", port + "").replace("{{project_id}}", projectId).replace("{{graph_name}}", graphName);
        doCypherQuery(url, iamHeader);
    }

    public static void doCypherQuery(String url, Map<String, String> iamHeaders) {
        Properties prop = new Properties();
        for (Map.Entry<String, String> pair : iamHeaders.entrySet()) {
            prop.setProperty(pair.getKey(), pair.getValue());
        }
        prop.setProperty("deserializer-type", "lazy");
        prop.setProperty("parse-json", "true");
        prop.setProperty("limit", "10000");
        try (Connection conn = DriverManager.getConnection(url, prop)) {
            String query = "match (m) return m limit 1";
            try (PreparedStatement stmt = conn.prepareStatement(query)) {
                try (ResultSet rs = stmt.executeQuery()) {
                    Object o = null;
                    while (rs.next()) {
                        GesElement.GesVertex vertex = (GesElement.GesVertex) rs.getObject("m");
                        System.out.println(vertex.getId());
                        System.out.println(vertex.getLabels());
                        System.out.println(vertex.getProperties());
                    }
                }
            }
        }
    }
}
```

```
        }
    }
} catch (SQLException e) {
    logger.info("Execute SQL query error.");
}
}
```

# 7 SDK 和 REST API 的关系

表 7-1 SDK 和 REST API 的关系

Interface	Method	API
Graph Business API	addVertex()	POST /ges/v1.0/{projectId}/graphs/{graphName}/vertices
	deleteVertex(GraphClient graphClient)	DELETE /ges/v1.0/{projectId}/graphs/{graphName}/vertices/{vertexId}/
	vertexQuery(GraphClient graphClient)	POST /ges/v1.0/{projectId}/graphs/{graphName}/vertices/action?action_id=query
	getVertices(GraphClient graphClient)	GET /ges/v1.0/{projectId}/graphs/{graphName}/vertices/detail?vertexIds={vertexIds}
	addEdge(GraphClient graphClient)	POST /ges/v1.0/{projectId}/graphs/{graphName}/edges
	deleteEdge(GraphClient graphClient)	DELETE /ges/v1.0/{projectId}/graphs/{graphName}/edges?source={sourceVertex}&target={targetVertex}&index={index}

Interface	Method	API
	edgeQuery(GraphClient graphClient)	POST /ges/v1.0/{projectId}/graphs/{graphName}/edges/action? action_id=query
	getEdge(GraphClient graphClient)	GET /ges/v1.0/{projectId}/graphs/{graphName}/edges/detail? source={sourceVertex}&target={targetVertex}&index={index}
	getSchema(GraphClient graphClient)	GET /ges/v1.0/{projectId}/graphs/{graphName}/schema
	getSummary(GraphClient graphClient)	GET /ges/v1.0/{projectId}/graphs/{graphName}/summary
	executeGremlinQuery(Graph Client graphClient, String graphName)	POST /ges/v1.0/{projectId}/{userId}/graphs/action? action_id=execute-gremlin-query
	addLabel(GraphClient graphClient)	POST /ges/v1.0/{projectId}/graphs/{graphName}/schema?labels
	excuteCreateIndex(GraphClient graphClient)	POST /ges/v1.0/{projectId}/graphs/{graphName}/indices
	excuteDeleteIndex(GraphClient graphClient)	DELETE /ges/v1.0/{projectId}/graphs/{graphName}/indices/{indexName}
	excuteQueryIndex(GraphClient graphClient)	GET /ges/v1.0/{projectId}/graphs/{graphName}/indices
	exportGraph(GraphClient graphClient)	POST /ges/v1.0/{projectId}/graphs/{graphName}/action? action_id=export-graph

Interface	Method	API
	clearGraph(GraphClient graphClient)	POST /ges/v1.0/{projectId}/graphs/{graphName}/action? action_id=clear-graph
	queryAsyncTask(GraphClient graphClient, String jobId)	GET /ges/v1.0/{projectId}/graphs/jobs/{jobId}? offset=offset&limit=limit
	stopAsyncTask(GraphClient graphClient, String jobId)	DELETE /ges/v1.0/{projectId}/graphs/jobs/{jobId}
	executeAlgorithm(GraphClient graphClient, String graphName)	POST /ges/v1.0/{projectId}/{userId}/graphs/action? action_id=execute-algorithm
Graph Management API	getQuotas(GesClient client)	GET /v1.0/{projectId}/graphs/quotas
	checkSchema(GesClient client)	POST /v1.0/{projectId}/graphs/action? action_id=check-schema
	listGraphs(GesClient client)	GET /v1.0/{projectId}/graphs? offset={offset}&limit={limit}
	getGraphDetail(GesClient client, String graphId)	GET /v1.0/{projectId}/graphs/{graphId}
	createGraph(GesClient client)	POST /v1.0/{projectId}/graphs
	stopGraph(GesClient client, String graphId)	POST /v1.0/{projectId}/graphs/{graphId}/action? action_id=stop
	startGraph(GesClient client, String graphId)	POST /v1.0/{projectId}/graphs/{graphId}/action? action_id=start

Interface	Method	API
	deleteGraph(GesClient client, String graphId)	DELETE /v1.0/{projectId}/graphs/ {graphId}
	listBackups(GesClient client)	GET /v1.0/{projectId}/graphs/ backups? offset={offset}&limit={limit}
	listBackupsByGraphId(GesClient client, String graphId)	GET /v1.0/{projectId}/graphs/ {graphId}/backups? offset={offset}&limit={limit}
	createBackup(GesClient client, String graphId)	POST /v1.0/{projectId}/graphs/ {graphId}/backups
	deleteBackup(GesClient client, String graphId, String backupId)	DELETE /v1.0/{projectId}/graphs/ {graphId}/backups/ {backup_id}
	getJobStatus(GesClient client, String graphId, String jobId)	GET /v1.0/{projectId}/graphs/ {graphId}/jobs/{jobId}/status