# ArcSoft Face Detection

## 开发指导文档

ArcSoft Corporation
46601 Fremont Blvd.
Fremont, CA 94538
http://www.arcsoft.com

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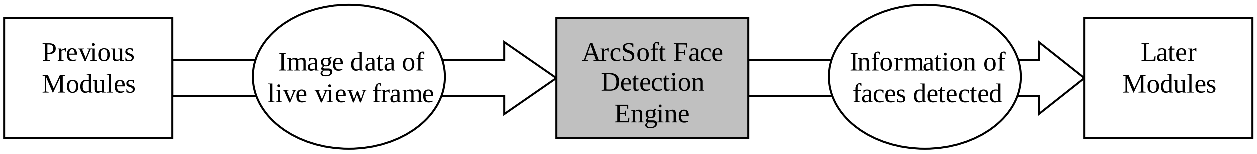
# 1. 概述

虹软人脸检测引擎工作流程图：


Previous Modules
Image data of live view frame
ArcSoft Face Detection Engine
Information of faces detected
Later Modules

## 1.1. 运行环境

- Linux x64

## 1.2. 系统要求

- 库依赖 GLIBC 2.19 及以上
- 编译器 GCC 4.8.2 及以上

## 1.3. 依赖库

- libsqlite3
- libcurl

# 2. 结构与常量

## 2.1. 基本类型

```
typedef MInt32 AFD_FSDK_OrientPriority;
typedef MInt32 AFD_FSDK_OrientCode;
```

所有基本类型在平台库中有定义。 定义规则是在 ANSIC 中的基本类型前加上字母“M”同时将类型的第一个字母改成大写。例如“long” 被定义成“MLong”

## 2.2. 数据结构与枚举

### 2.2.1. AFD_FSDK_FACERES

**描述**

检测到的脸部信息

**定义**

```
typedef struct{
    MInt32    nFace;
    MRECT     *rcFace;
    AFD_FSDK_OrientCode     *lfaceOrient;
} AFD_FSDK_FACERES, *LPAFD_FSDK_FACERES;
```

**成员变量**

| | |
|---|---|
| rcFace | 人脸矩形框信息 |
| nFace | 人脸个数 |
| lfaceOrient | 人脸角度信息 |

### 2.2.2. AFD_FSDK_VERSION

**描述**

SDK 版本信息

**定义**

```
 typedef struct
 {
   MInt32 lCodebase;
```

```
    MInt32 lMajor;
    MInt32 lMinor;
    MInt32 lBuild;
    MPChar Version;
    MPChar BuildDate;
    MPChar CopyRight;
 } AFD_FSDK_Version;
```

**成员描述**

| | |
|---|---|
| lCodebase | 代码库版本号 |
| lMajor | 主版本号 |
| lMinor | 次版本号 |
| lBuild | 编译版本号，递增 |
| Version | 字符串形式的版本号 |
| BuildDate | 编译时间 |
| CopyRight | 版权信息 |

## 2.2.3. AFD_FSDK_OrientPriority

**描述**

定义脸部检测角度的优先级

**定义**

```
enum _AFD_FSDK_OrientPriority{
    AFD_FSDK_OPF_0_ONLY           = 0x1,
    AFD_FSDK_OPF_90_ONLY          = 0x2,
    AFD_FSDK_OPF_270_ONLY         = 0x3,
    AFD_FSDK_OPF_180_ONLY         = 0x4,
    AFD_FSDK_OPF_0_HIGHER_EXT     = 0x5
};
```

**成员描述**

| | |
|---|---|
| AFD_FSDK_OPF_0_ONLY | 检测 0 度（±45 度）方向 |
| AFD_FSDK_OPF_90_ONLY | 检测 90 度（±45 度）方向 |
| AFD_FSDK_OPF_270_ONLY | 检测 270（±45 度）度方向 |
| AFD_FSDK_OPF_180_ONLY | 检测 180 度（±45 度）方向 |
| AFD_FSDK_OPF_0_HIGHER_EXT | 检测 0， 90， 180， 270 四个方向, 0 度更优先 |

## 2.2.4. AFD_FSDK_OrientCode

**描述**

定义检测结果中的人脸角度

**定义**

```
enum _AFD_FSDK_OrientCode{
    AFD_FSDK_FOC_0   = 0x1,
    AFD_FSDK_FOC_90  = 0x2,
    AFD_FSDK_FOC_270 = 0x3,
    AFD_FSDK_FOC_180 = 0x4,
    AFD_FSDK_FOC_30  = 0x5,
    AFD_FSDK_FOC_60  = 0x6,
    AFD_FSDK_FOC_120 = 0x7,
    AFD_FSDK_FOC_150 = 0x8,
    AFD_FSDK_FOC_210 = 0x9,
    AFD_FSDK_FOC_240 = 0xa,
    AFD_FSDK_FOC_300 = 0xb,
    AFD_FSDK_FOC_330 = 0xc
};
```

**成员描述**

| | |
|---|---|
| AFD_FSDK_FOC_0 | 0 度 |
| AFD_FSDK_FOC_90 | 90 度 |
| AFD_FSDK_FOC_270 | 270 度 |
| AFD_FSDK_FOC_180 | 180 度 |
| AFD_FSDK_FOC_30 | 30 度 |
| AFD_FSDK_FOC_60 | 60 度 |
| AFD_FSDK_FOC_120 | 120 度 |
| AFD_FSDK_FOC_150 | 150 度 |
| AFD_FSDK_FOC_210 | 210 度 |
| AFD_FSDK_FOC_240 | 240 度 |
| AFD_FSDK_FOC_300 | 300 度 |
| AFD_FSDK_FOC_330 | 330 度 |

### 2.2.5. 支持的颜色格式

| 定义 | 说明 |
|---|---|
| ASVL_PAF_I420 | 8-bit Y 通道，8-bit 2x2 采样 U 通道，8-bit 2x2 采样 V 通道 |
| ASVL_PAF_NV12 | 8-bit Y 通道，8-bit 2x2 采样 U 与 V 分量交织通道 |
| ASVL_PAF_NV21 | 8-bit Y 通道，8-bit 2x2 采样 V 与 U 分量交织通道 |
| ASVL_PAF_YUYV | YUV 分量交织，V 与 U 分量 2x1 采样，按 Y0, U0, Y1, V0 字节序排布 |
| ASVL_PAF_RGB24_B8G8R8 | RGB 分量交织，按 B, G, R, B 字节序排布 |

# 3. API 说明

## 3.1. AFD_FSDK_InitialFaceEngine

**原型**

```
MRESULT AFD_FSDK_InitialFaceEngine(
       MPChar                             AppId,
       MPChar                             SDKKey,
       MByte                              *pMem,
       MInt32                             lMemSize,
       MHandle                            *pEngine,
       AFD_FSDK_OrientPriority            iOrientPriority,
       MInt32                             nScale,
       MInt32                             nMaxFaceNum
);
```

**描述**

初始化脸部检测引擎

**参数**

| | | |
|---|---|---|
| AppId | [in] | 用户申请SDK时获取的App Id |
| SDKKey | [in] | 用户申请SDK时获取的SDK Key |
| pMem | [in] | 分配给引擎使用的内存地址 |
| lMemSize | [in] | 分配给引擎使用的内存大小 |
| pEngine | [out] | 引擎handle |
| iOrientPriority | [in] | 期望的脸部角度的检测范围 |
| nScale | [in] | 用于数值表示的最小人脸尺寸 有效值范围[2,50] 推荐值 16。<br>该尺寸是人脸相对于所在图片的长边的占比。例如，如果用户想检测到的最小人脸尺寸是图片长度的1/8，那么这个nScale就应该设置为8 |
| nMaxFaceNum | [in] | 用户期望引擎最多能检测出的人脸数 有效值范围[1,50] |

**返回值**

成功返回MOK，否则返回失败code。失败codes如下所列:

| | |
|---|---|
| MERR_INVALID_PARAM | 参数输入非法 |
| MERR_NO_MEMORY | 内存不足 |

## 3.2. AFD_FSDK_StillImageFaceDetection

**原型**

```
MRESULT AFD_FSDK_StillImageFaceDetection(
     MHandle                  hEngine,
     LPASVLOFFSCREEN          pImgData,
     LPAFD_FSDK_FACERES      *pFaceRes
);
```

**描述**

根据输入的图像检测出人脸位置，一般用于静态图像检测

**参数**

| | | |
|---|---|---|
| hEngine | [in] | 引擎 handle |
| pImgData | [in] | 待检测图像信息 |
| pFaceRes | [out] | 人脸检测结果 |

**返回值**

成功返回 MOK，否则返回失败 code。

## 3.3. AFD_FSDK_UninitialFaceEngine

**原型**

```
MRESULT AFD_FSDK_UninitialFaceEngine(
       MHandle       hEngine
);
```

**描述**

销毁引擎，释放相应资源

**参数**

| | | |
|---|---|---|
| hEngine | [in] | 引擎 handle |

**返回值**

成功返回 MOK，否则返回失败 code。失败 codes 如下所列:

| | |
|---|---|
| MERR_INVALID_PARAM | 参数输入非法 |

## 3.4. AFD_FSDK_GetVersion

**原型**

```
const AFD_FSDK_Version * AFD_FSDK_GetVersion(
        MHandle         hEngine
);
```

**描述**

获取 SDK 版本信息

**参数**

| | | |
|---|---|---|
| hEngine | [in] | 引擎 handle |

# 4. 示例代码

注意,使用时请替换申请的 APPID 和 SDKKEY，并设置好文件路径和图像尺寸

```
#include <stdlib.h>
#include <stdio.h>
#include <stdint.h>
#include <string.h>
#include <errno.h>
#include <assert.h>


#include "arcsoft_fsdk_face_detection.h"
#include "merror.h"

//#define APPID     "your appid"
//#define SDKKEY    "your sdkkey"

#define INPUT_IMAGE_FORMAT  ASVL_PAF_I420
#define INPUT_IMAGE_PATH    "your_input_image.yuv"
#define INPUT_IMAGE_WIDTH   (640)
#define INPUT_IMAGE_HEIGHT  (480)

#define WORKBUF_SIZE        (40*1024*1024)
#define MAX_FACE_NUM        (50)

int fu_ReadFile(const char* path, uint8_t **raw_data, size_t* pSize) {
    int res = 0;
    FILE *fp = 0;
    uint8_t *data_file = 0;
    size_t size = 0;

    fp = fopen(path, "rb");
    if (fp == nullptr) {
        res = -1;
        goto exit;
    }

    fseek(fp, 0, SEEK_END);
    size = ftell(fp);
    fseek(fp, 0, SEEK_SET);

    data_file = (uint8_t *)malloc(sizeof(uint8_t)* size);
    if (data_file == nullptr) {
        res = -2;
        goto exit;
    }

    if (size != fread(data_file, sizeof(uint8_t), size, fp)) {
        res = -3;
        goto exit;
    }

    *raw_data = data_file;
    data_file = nullptr;
exit:
    if (fp != nullptr) {
        fclose(fp);
    }

    if (data_file != nullptr) {
        free(data_file);
    }

    if (nullptr != pSize) {
        *pSize = size;
    }

    return res;
}


int main(int argc, char* argv[]) {

    MByte *pWorkMem = (MByte *)malloc(WORKBUF_SIZE);
    if(pWorkMem == nullptr){
        fprintf(stderr, "fail to malloc workbuf\r\n");
        exit(0);
    }

    MHandle hEngine = nullptr;

    int ret = AFD_FSDK_InitialFaceEngine(APPID, SDKKEY, pWorkMem, WORKBUF_SIZE,
                                         &hEngine, AFD_FSDK_OPF_0_HIGHER_EXT,
16, MAX_FACE_NUM);
    if (ret != 0) {
        fprintf(stderr, "fail to AFD_FSDK_InitialFaceEngine(): 0x%x\r\n", ret);
        free(pWorkMem);
        exit(0);
    }

    const AFD_FSDK_Version*pVersionInfo = AFD_FSDK_GetVersion(hEngine);
    printf("%d %d %d %d\r\n", pVersionInfo->lCodebase, pVersionInfo->lMajor,
                                 pVersionInfo->lMinor, pVersionInfo->lBuild);
    printf("%s\r\n", pVersionInfo->Version);
    printf("%s\r\n", pVersionInfo->BuildDate);
    printf("%s\r\n", pVersionInfo->CopyRight);

    ASVLOFFSCREEN inputImg = { 0 };
    inputImg.u32PixelArrayFormat = INPUT_IMAGE_FORMAT;
    inputImg.i32Width = INPUT_IMAGE_WIDTH;
    inputImg.i32Height = INPUT_IMAGE_HEIGHT;
    inputImg.ppu8Plane[0] = nullptr;
    fu_ReadFile(INPUT_IMAGE_PATH, (uint8_t**)&inputImg.ppu8Plane[0], nullptr);
     if (!inputImg.ppu8Plane[0]) {
        fprintf(stderr, "fail to fu_ReadFile(%s): %s\r\n", INPUT_IMAGE_PATH, 
strerror(errno));
        AFD_FSDK_UninitialFaceEngine(hEngine);
        free(pWorkMem);
        exit(0);
    }

    if (ASVL_PAF_I420 == inputImg.u32PixelArrayFormat) {
        inputImg.pi32Pitch[0] = inputImg.i32Width;
        inputImg.pi32Pitch[1] = inputImg.i32Width/2;
        inputImg.pi32Pitch[2] = inputImg.i32Width/2;
        inputImg.ppu8Plane[1] = inputImg.ppu8Plane[0] + inputImg.pi32Pitch[0] 
* inputImg.i32Height;
        inputImg.ppu8Plane[2] = inputImg.ppu8Plane[1] + inputImg.pi32Pitch[1] 
* inputImg.i32Height/2;
    } else if (ASVL_PAF_NV12 == inputImg.u32PixelArrayFormat) {
        inputImg.pi32Pitch[0] = inputImg.i32Width;
        inputImg.pi32Pitch[1] = inputImg.i32Width;
        inputImg.ppu8Plane[1] = inputImg.ppu8Plane[0] + (inputImg.pi32Pitch[0] 
* inputImg.i32Height);
    } else if (ASVL_PAF_NV21 == inputImg.u32PixelArrayFormat) {
        inputImg.pi32Pitch[0] = inputImg.i32Width;
        inputImg.pi32Pitch[1] = inputImg.i32Width;
        inputImg.ppu8Plane[1] = inputImg.ppu8Plane[0] + (inputImg.pi32Pitch[0] 
* inputImg.i32Height);
    } else if (ASVL_PAF_YUYV == inputImg.u32PixelArrayFormat) {
        inputImg.pi32Pitch[0] = inputImg.i32Width*2;
    } else if (ASVL_PAF_I422H == inputImg.u32PixelArrayFormat) {
        inputImg.pi32Pitch[0] = inputImg.i32Width;
        inputImg.pi32Pitch[1] = inputImg.i32Width / 2;
        inputImg.pi32Pitch[2] = inputImg.i32Width / 2;
        inputImg.ppu8Plane[1] = inputImg.ppu8Plane[0] + inputImg.pi32Pitch[0] 
* inputImg.i32Height;
        inputImg.ppu8Plane[2] = inputImg.ppu8Plane[1] + inputImg.pi32Pitch[1] 
* inputImg.i32Height;
    } else if (ASVL_PAF_LPI422H == inputImg.u32PixelArrayFormat) {
        inputImg.pi32Pitch[0] = inputImg.i32Width;
        inputImg.pi32Pitch[1] = inputImg.i32Width;
        inputImg.ppu8Plane[1] = inputImg.ppu8Plane[0] + (inputImg.pi32Pitch[0] 
* inputImg.i32Height);
    } else if (ASVL_PAF_RGB24_B8G8R8 == inputImg.u32PixelArrayFormat) {
        inputImg.pi32Pitch[0] = inputImg.i32Width*3;
    } else if (ASVL_PAF_RGB24_R8G8B8 == inputImg.u32PixelArrayFormat) {
        inputImg.pi32Pitch[0] = inputImg.i32Width * 3;
    } else if (ASVL_PAF_RGB32_B8G8R8A8 == inputImg.u32PixelArrayFormat) {
        inputImg.pi32Pitch[0] = inputImg.i32Width * 4;
    } else {
        fprintf(stderr, "unsupported Image format: 
0x%x\r\n",inputImg.u32PixelArrayFormat);
        free(inputImg.ppu8Plane[0]);
         AFD_FSDK_UninitialFaceEngine(hEngine);
        free(pWorkMem);
        exit(0);
    }
    LPAFD_FSDK_FACERES faceResult;
    ret = AFD_FSDK_StillImageFaceDetection(hEngine, &inputImg, &faceResult);
    if (ret != 0) {
        fprintf(stderr, "fail to AFD_FSDK_StillImageFaceDetection(): 0x%x\r\n", 
ret);
        free(inputImg.ppu8Plane[0]);
        AFD_FSDK_UninitialFaceEngine(hEngine);
        free(pWorkMem);
        exit(0);
    }


    for (int i = 0; i < faceResult->nFace; i++) {
        printf("face %d:(%d,%d,%d,%d)\r\n", i,
               faceResult->rcFace[i].left, faceResult->rcFace[i].top,
               faceResult->rcFace[i].right, faceResult->rcFace[i].bottom);

    }


    free(inputImg.ppu8Plane[0]);
    AFD_FSDK_UninitialFaceEngine(hEngine);
    free(pWorkMem);

    return 0;
}
```