**Documentation**

流程

[基于深度学习框架yolov5的钢铁表面缺陷检测](https://blog.csdn.net/weixin_39735688/article/details/121390085?spm=1001.2101.3001.6650.1&utm_medium=distribute.pc_relevant.none-task-blog-2%7Edefault%7ECTRLIST%7Edefault-1-121390085-blog-124982986.pc_relevant_multi_platform_whitelistv1_exp2&depth_1-utm_source=distribute.pc_relevant.none-task-blog-2%7Edefault%7ECTRLIST%7Edefault-1-121390085-blog-124982986.pc_relevant_multi_platform_whitelistv1_exp2&utm_relevant_index=2)

[python图像缺陷识别算法\_python opencv图像缺陷比对（轮廓比对）\_weixin\_39713335的博客](https://blog.csdn.net/weixin_39713335/article/details/110283800)

1. 导入图片
2. 图片处理

[数字图像处理与Python实现笔记之基础知识](https://hulin.blog.csdn.net/article/details/107570020)

* 1. 图像基本信息

[img.shape[0]、[1]、[2]的意思](https://blog.csdn.net/qq_45616304/article/details/108323636)

* 1. 灰度化
  2. 灰度直方图

[Python+OpenCV绘制灰度直方图详解](https://www.jb51.net/article/241724.htm)

[绘制图像灰度直方图——将图像的灰度分布可视化方法总结](https://blog.csdn.net/kuwola/article/details/122546479)

[OPENCV学习之：获取图片的灰度分布图，对图片进行二值化处理](https://www.freesion.com/article/42061251876/)

* 1. 灰度化相关处理

[OpenCV图像增强python](https://www.cnblogs.com/supershuai/p/12436669.html#:~:text=OpenCV%E5%9B%BE%E5%83%8F%E5%A2%9E%E5%BC%BA%EF%BC%88python%EF%BC%89.,%E4%B8%BA%E4%BA%86%E5%BE%97%E5%88%B0%E6%9B%B4%E5%8A%A0%E6%B8%85%E6%99%B0%E7%9A%84%E5%9B%BE%E5%83%8F%E6%88%91%E4%BB%AC%E9%9C%80%E8%A6%81%E9%80%9A%E8%BF%87%E6%8A%80%E6%9C%AF%E5%AF%B9%E5%9B%BE%E5%83%8F%E8%BF%9B%E8%A1%8C%E5%A4%84%E7%90%86%EF%BC%8C%E6%AF%94%E5%A6%82%E4%BD%BF%E7%94%A8%E5%AF%B9%E6%AF%94%E5%BA%A6%E5%A2%9E%E5%BC%BA%E7%9A%84%E6%96%B9%E6%B3%95%E6%9D%A5%E5%A4%84%E7%90%86%E5%9B%BE%E5%83%8F%EF%BC%8C%E5%AF%B9%E6%AF%94%E5%BA%A6%E5%A2%9E%E5%BC%BA%E5%B0%B1%E6%98%AF%E5%AF%B9%E5%9B%BE%E5%83%8F%E8%BE%93%E5%87%BA%E7%9A%84%E7%81%B0%E5%BA%A6%E7%BA%A7%E6%94%BE%E5%A4%A7%E5%88%B0%E6%8C%87%E5%AE%9A%E7%9A%84%E7%A8%8B%E5%BA%A6%EF%BC%8C%E8%8E%B7%E5%BE%97%E5%9B%BE%E5%83%8F%E8%B4%A8%E9%87%8F%E7%9A%84%E6%8F%90%E5%8D%87%E3%80%82.%20%E6%9C%AC%E6%96%87%E4%B8%BB%E8%A6%81%E9%80%9A%E8%BF%87%E4%BB%A3%E7%A0%81%E7%9A%84%E6%96%B9%E5%BC%8F%EF%BC%8C%E9%80%9A%E8%BF%87OpenCV%E7%9A%84%E5%86%85%E7%BD%AE%E5%87%BD%E6%95%B0%E5%B0%86%E5%9B%BE%E5%83%8F%E5%A4%84%E7%90%86%E5%88%B0%E6%88%91%E4%BB%AC%E7%90%86%E6%83%B3%E7%9A%84%E7%BB%93%E6%9E%9C%E3%80%82)

[数字图像处理-空间域处理-灰度变换-基本灰度变换函数（反转变换、对数变换、伽马变换和分段线性变换） - Laumians - 博客园](https://www.cnblogs.com/laumians-notes/p/8629396.html)

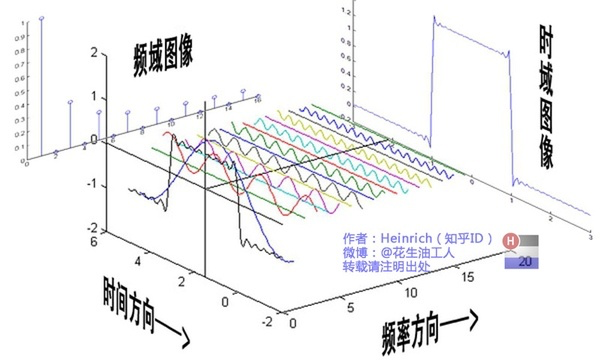
* 1. 归一化

[怎么理解矩阵归一化？ - 易拉罐的回答- 知乎](https://www.zhihu.com/question/315340450/answer/619717396)

1. 图片检测
   1. 傅里叶变换：

“提出其中的高频分量做傅里叶逆变换得到的就是锐化的结果（高通滤波器）。 提出其中的低频分量做傅里叶逆变换得到的就是模糊的结果（低通滤波器）。”

“对于正弦信号，如果幅度在短时间内变化比较快，则可以说它是高频信号，如果变化缓慢，则为低频信号，我们可以将相同的想法扩展到图像，**图像中的振幅在哪里急剧变化？当然是在边缘点或噪声，因此，可以说边缘和噪声是图像中的高频内容**”



[如何理解傅里叶变换公式？ - 知乎](https://www.zhihu.com/question/19714540)

[深入浅出的讲解傅里叶变换（真正的通俗易懂）](https://blog.csdn.net/l494926429/article/details/51818012/)

[傅里叶变换，有史以来最伟大的数学发现之一，理解其背后的直觉](https://baijiahao.baidu.com/s?id=1711309753031579562&wfr=spider&for=pc)

* 1. 应用：图像增强、图像去噪、边缘检测、特征提取

[傅里叶变换与图像处理](https://blog.csdn.net/fengshengwei3/article/details/121788974?spm=1001.2101.3001.6650.5&utm_medium=distribute.pc_relevant.none-task-blog-2%7Edefault%7EBlogCommendFromBaidu%7Edefault-5-121788974-blog-105592350.pc_relevant_default&depth_1-utm_source=distribute.pc_relevant.none-task-blog-2%7Edefault%7EBlogCommendFromBaidu%7Edefault-5-121788974-blog-105592350.pc_relevant_default)

[傅里叶变换在图像处理中的应用初步学习](https://blog.csdn.net/bcbobo21cn/article/details/108460149?spm=1001.2101.3001.6650.2&utm_medium=distribute.pc_relevant.none-task-blog-2%7Edefault%7ECTRLIST%7Edefault-2-108460149-blog-105592350.pc_relevant_default&depth_1-utm_source=distribute.pc_relevant.none-task-blog-2%7Edefault%7ECTRLIST%7Edefault-2-108460149-blog-105592350.pc_relevant_default)

[python\_傅里叶变换（DFT、FFT、STFT）](https://blog.csdn.net/qq_34229228/article/details/123417079?spm=1001.2101.3001.6661.1&utm_medium=distribute.pc_relevant_t0.none-task-blog-2%7Edefault%7ECTRLIST%7Edefault-1-123417079-blog-124175063.pc_relevant_default&depth_1-utm_source=distribute.pc_relevant_t0.none-task-blog-2%7Edefault%7ECTRLIST%7Edefault-1-123417079-blog-124175063.pc_relevant_default&utm_relevant_index=1)

* + 1. 图像掩膜

[图像处理之图像位运算与图像掩膜](https://blog.csdn.net/qq_42886635/article/details/115015529?utm_medium=distribute.pc_relevant.none-task-blog-2~default~baidujs_title~default-0-115015529-blog-122514586.pc_relevant_multi_platform_whitelistv2&spm=1001.2101.3001.4242.1&utm_relevant_index=3)

[opencv颜色空间转换、阈值构建掩膜、原图像和掩模进行位运算](https://blog.csdn.net/qq_42102546/article/details/122514586)

* + 1. 离散傅里叶变换DFT

[OpenCV中的图像处理—— 傅里叶变换+模板匹配](https://blog.csdn.net/qq_50587771/article/details/124543040)

[OpenCV中的图像变换——傅里叶变换](https://blog.csdn.net/qq_40985985/article/details/119007945?ops_request_misc=%257B%2522request%255Fid%2522%253A%2522165147586316782248529605%2522%252C%2522scm%2522%253A%252220140713.130102334..%2522%257D&request_id=165147586316782248529605&biz_id=0&utm_medium=distribute.pc_search_result.none-task-blog-2~all~sobaiduend~default-2-119007945.142%5Ev9%5Econtrol,157%5Ev4%5Econtrol&utm_term=OpenCV%E4%B8%AD%E7%9A%84%E5%82%85%E9%87%8C%E5%8F%B6%E5%8F%98%E6%8D%A2&spm=1018.2226.3001.4187)

[图像去噪、增强、边缘检测----两种方法实现傅里叶变换Numpy和OpenCV](https://zwzhao.blog.csdn.net/article/details/124422422?spm=1001.2101.3001.6650.3&utm_medium=distribute.pc_relevant.none-task-blog-2%7Edefault%7ECTRLIST%7Edefault-3-124422422-blog-105205210.pc_relevant_multi_platform_whitelistv2&depth_1-utm_source=distribute.pc_relevant.none-task-blog-2%7Edefault%7ECTRLIST%7Edefault-3-124422422-blog-105205210.pc_relevant_multi_platform_whitelistv2&utm_relevant_index=6)

[使用傅里叶变换进行图像边缘检测](https://blog.csdn.net/sinat_17456165/article/details/105592350?spm=1001.2101.3001.6650.8&utm_medium=distribute.pc_relevant.none-task-blog-2%7Edefault%7EBlogCommendFromBaidu%7Edefault-8-105592350-blog-105205210.pc_relevant_multi_platform_whitelistv2&depth_1-utm_source=distribute.pc_relevant.none-task-blog-2%7Edefault%7EBlogCommendFromBaidu%7Edefault-8-105592350-blog-105205210.pc_relevant_multi_platform_whitelistv2&utm_relevant_index=14)

[python+OpenCV笔记（三十九）：离散傅里叶变换（DFT）](https://blog.csdn.net/qq_45832961/article/details/124175063)

* + 1. 小波变换

[如何通俗地讲解傅立叶分析和小波分析间的关系？](https://www.zhihu.com/question/22864189/answer/40772083)

* + 1. 带通滤波器：“使图像在某一部分的频率信息通过，其他过低或过高都抑制”

[一文讲懂图像处理中的低通、高通、带阻和带通滤波器](http://www.360doc.com/content/22/0222/10/73571518_1018491236.shtml)

[数字图像处理与python实现-带通滤波器](https://wenku.baidu.com/view/b5a3558cd2f34693daef5ef7ba0d4a7302766c25.html)

[数字图像处理-频域滤波-带通/带阻滤波- Laumians - 博客园](https://www.cnblogs.com/laumians-notes/p/8600688.html)

* + 1. SIFT特征识别

算法理论：

·[特征点检测学习\_1(sift算法) - tornadomeet - 博客园](https://www.cnblogs.com/tornadomeet/archive/2012/08/16/2643168.html)

·[计算机视觉3 SIFT特征提取与全景图像拼接\_江正阳的博客](https://blog.csdn.net/JiangZhengyang7/article/details/124380879)

·[特征检测算法--SIFT\_淮南草的博客](https://blog.csdn.net/zhuisaozhang1292/article/details/80982294)

·[SIFT特征点提取](https://blog.csdn.net/lingyunxianhe/article/details/79063547)

代码实现：

·[应用OpenCV和Python进行SIFT算法的实现](https://blog.csdn.net/zhangziju/article/details/79754652)

·[Python计算机视觉——SIFT特征提取与检索](https://blog.csdn.net/qq_43241436/article/details/104649812?spm=1001.2101.3001.6661.1&utm_medium=distribute.pc_relevant_t0.none-task-blog-2%7Edefault%7ECTRLIST%7Edefault-1-104649812-blog-79754652.pc_relevant_aa&depth_1-utm_source=distribute.pc_relevant_t0.none-task-blog-2%7Edefault%7ECTRLIST%7Edefault-1-104649812-blog-79754652.pc_relevant_aa&utm_relevant_index=1)

·[python3 SIFT算法的实现\_YL\_4EVER的博客](https://blog.csdn.net/qq_38554218/article/details/83031839)

·[OpenCV全景图像拼接的实现示例](http://www.iis7.com/a/nr/wz/202108/44800.html)

·[OpenCV和Python进行SIFT算法——两张图片的拼接](https://blog.csdn.net/qq_43279579/article/details/117716070)

# 尺度空间：“因为计算机在进行图像分析时，并不知道图像的真实尺寸大小，需要考虑多尺度以获取感兴趣物体的最佳尺度。同时，在一幅图像的不同尺度下检测出相同的关键点来匹配，即尺度不变性。”——应用高斯核（高斯模糊）进行多尺度变换

·[尺度空间与图像金字塔（一）\_zlinzju的博客](https://blog.csdn.net/weixin_43026262/article/details/103138098)

·[尺度空间与图像金字塔（二）\_zlinzju的博客](https://blog.csdn.net/weixin_43026262/article/details/103164192)

# 图像梯度：“图像的边缘包含了大量的梯度信息，基于梯度进行边缘检测简单有效。”

·[图像梯度(Image Gradient)](http://www.javashuo.com/article/p-sdcvhdfy-oq.html)

# 视角变换：“仿射变换和透视变换更直观的叫法可以叫做「平面变换」和「空间变换」或者「二维坐标变换」和「三维坐标变换」。”

·[图片视角转换cv2.warpPerspective\_卓晴的博客](https://blog.csdn.net/zhuoqingjoking97298/article/details/121455185)

·[图像处理的仿射变换与透视变换](https://zhuanlan.zhihu.com/p/36082864/)

* + 1. 轮廓提取与切割

[opencv学习—cv2.findContours()函数讲解（python）\_岁月蹉跎的一杯酒的博客](https://blog.csdn.net/weixin_44690935/article/details/109008946)

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1. YOLOv5

<https://github.com/ultralytics/yolov5/blob/master/.github/README_cn.md>

[Quick Start - YOLOv5 Documentation](https://docs.ultralytics.com/quick-start/)

[深入浅出Yolo系列之Yolov5核心基础知识完整讲解- 知乎](https://zhuanlan.zhihu.com/p/172121380)

[Yolov5 系列1--- Yolo发展史以及Yolov5模型详解](https://blog.csdn.net/g11d111/article/details/108845799?ops_request_misc=%257B%2522request%255Fid%2522%253A%2522163733275716780264059531%2522%252C%2522scm%2522%253A%252220140713.130102334..%2522%257D&request_id=163733275716780264059531&biz_id=0&utm_medium=distribute.pc_search_result.none-task-blog-2~all~baidu_landing_v2~default-4-108845799.first_rank_v2_pc_rank_v29&utm_term=yolov5%E6%A8%A1%E5%9E%8B&spm=1018.2226.3001.4187)

* 1. 范例

[基于深度学习框架yolov5的钢铁表面缺陷检测](https://blog.csdn.net/weixin_39735688/article/details/121390085?spm=1001.2101.3001.6650.1&utm_medium=distribute.pc_relevant.none-task-blog-2%7Edefault%7ECTRLIST%7Edefault-1-121390085-blog-124982986.pc_relevant_multi_platform_whitelistv1_exp2&depth_1-utm_source=distribute.pc_relevant.none-task-blog-2%7Edefault%7ECTRLIST%7Edefault-1-121390085-blog-124982986.pc_relevant_multi_platform_whitelistv1_exp2&utm_relevant_index=2)

[【Yolov5】1.认真总结6000字Yolov5保姆级教程（全新版本2022.06.28）](https://blog.csdn.net/m0_53392188/article/details/119334634)

[基于YOLOV5的钢材缺陷检测实战](https://www.bilibili.com/video/BV17W4y127u8?p=5&vd_source=07362cc128605cb088616391243312d5)

* 1. Google Colab

[利用云端GPU训练YOLOv5模型](https://blog.csdn.net/qq_52237775/article/details/123317787?spm=1001.2101.3001.6650.1&utm_medium=distribute.pc_relevant.none-task-blog-2%7Edefault%7ECTRLIST%7Edefault-1-123317787-blog-124847185.pc_relevant_aa&depth_1-utm_source=distribute.pc_relevant.none-task-blog-2%7Edefault%7ECTRLIST%7Edefault-1-123317787-blog-124847185.pc_relevant_aa&utm_relevant_index=2)

* 1. 指标分析

[关于yolov5的一些简单说明(txt文件、训练结果分析等)](https://www.jb51.net/article/252841.htm)

1. 生成式对抗网络GAN
   1. GAN简介

[生成式对抗网络(GANs)简介](https://blog.csdn.net/weixin_38346042/article/details/121633697?spm=1001.2101.3001.6661.1&utm_medium=distribute.pc_relevant_t0.none-task-blog-2%7Edefault%7EBlogCommendFromBaidu%7Edefault-1-121633697-blog-102148393.pc_relevant_multi_platform_whitelistv1_exp2&depth_1-utm_source=distribute.pc_relevant_t0.none-task-blog-2%7Edefault%7EBlogCommendFromBaidu%7Edefault-1-121633697-blog-102148393.pc_relevant_multi_platform_whitelistv1_exp2&utm_relevant_index=1)

[一文看懂生成对抗网络 - GANs？（基本原理+10种典型算法+13种应用）](https://blog.csdn.net/weixin_43612023/article/details/96213305?utm_medium=distribute.pc_relevant.none-task-blog-2~default~baidujs_baidulandingword~default-0-96213305-blog-121633697.pc_relevant_multi_platform_whitelistv1_exp2&spm=1001.2101.3001.4242.1&utm_relevant_index=3)

[GAN详解 - 知乎](https://zhuanlan.zhihu.com/p/408766083)

* 1. 图像翻译
     1. Pix2Pix

[图像翻译之Pix2Pix - 知乎](https://zhuanlan.zhihu.com/p/464673225)

[pix2pix算法原理与实现\_VLU的博客](https://blog.csdn.net/weixin_42232024/article/details/110205087)

* + 1. CycleGAN

[炫酷的图像转换：从pix2pix到CycleGAN - 知乎](https://zhuanlan.zhihu.com/p/93219297)

[生成对抗网络GAN系列（六）--- CycleGAN---文末附代码\_Teeyohuang的博客](https://blog.csdn.net/Teeyohuang/article/details/82729047)

[基于CycleGan开源项目实战图像合成-Bilibili](https://www.bilibili.com/video/BV15a4y1H7Pt?p=2&vd_source=07362cc128605cb088616391243312d5)

* + 1. 范例

[[Pytorch系列-66]：生成对抗网络GAN - 图像生成开源项目pytorch-CycleGAN-and-pix2pix - 使用预训练模型测试pix2pix模型\_文火冰糖的硅基工坊的技术博客\_51CTO博客](https://blog.51cto.com/u_11299290/4865304)

[【论文笔记】CycleGAN（基于PyTorch框架） - 知乎](https://zhuanlan.zhihu.com/p/514551618)

[CycleGAN与pix2pix详解\_Coder\_L2的博客](https://blog.csdn.net/qq_41876456/article/details/119482933)

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相关模块

1. OpenCV: import cv2

[Python之cv2详解](https://wenku.baidu.com/view/6957b56a28160b4e767f5acfa1c7aa00b52a9d61.html)

[cv2库(OpenCV，opencv-python)的简介、安装、使用方法(常见函数、方法等)最强详细攻略](https://blog.csdn.net/fuhanghang/article/details/121260534)

[模块cv2的用法- 陨落&新生- 博客园](https://www.cnblogs.com/shizhengwen/p/8719062.html)

1. re: import re

[pythonrecompile中变量\_Python中re.compile函数起什么作用呢？\_weixin\_39662578的博客](https://blog.csdn.net/weixin_39662578/article/details/113499179)

1. shutil: import shutil

[一篇文章带你搞定Python中shutil模块](https://baijiahao.baidu.com/s?id=1716363868234453618&wfr=spider&for=pc)

1. os: import os
2. sys: import sys