

f3dFilter

Introduction

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f3dFilter

- New library in f3d
- Independent (like f3dla or f3dformat)
- Integrated into both f3dclass versions: streamed (version6) and all-in-memory (trunk)
- Functions for filtering (convolution) of volume data

Features

- Symmetric filters with sizes 3, 5, 7, 9, 11, 13, 15, 17
- Separable filter (arbitrary size)
- Nonseparable filter (arbitrary size)
- Standard (non-optimized) and SSE implementation

Available SSE Optimizations

Filter type	x86 (32-bit) arch	AMD64 (64-bit) arch
Symmetric h size 3, 5, 7, 9	✓	✓
Symmetric with size 11, 13, 15, 17		✓
Separable	✓	✓
Nonseparable	✓	✓

Usage

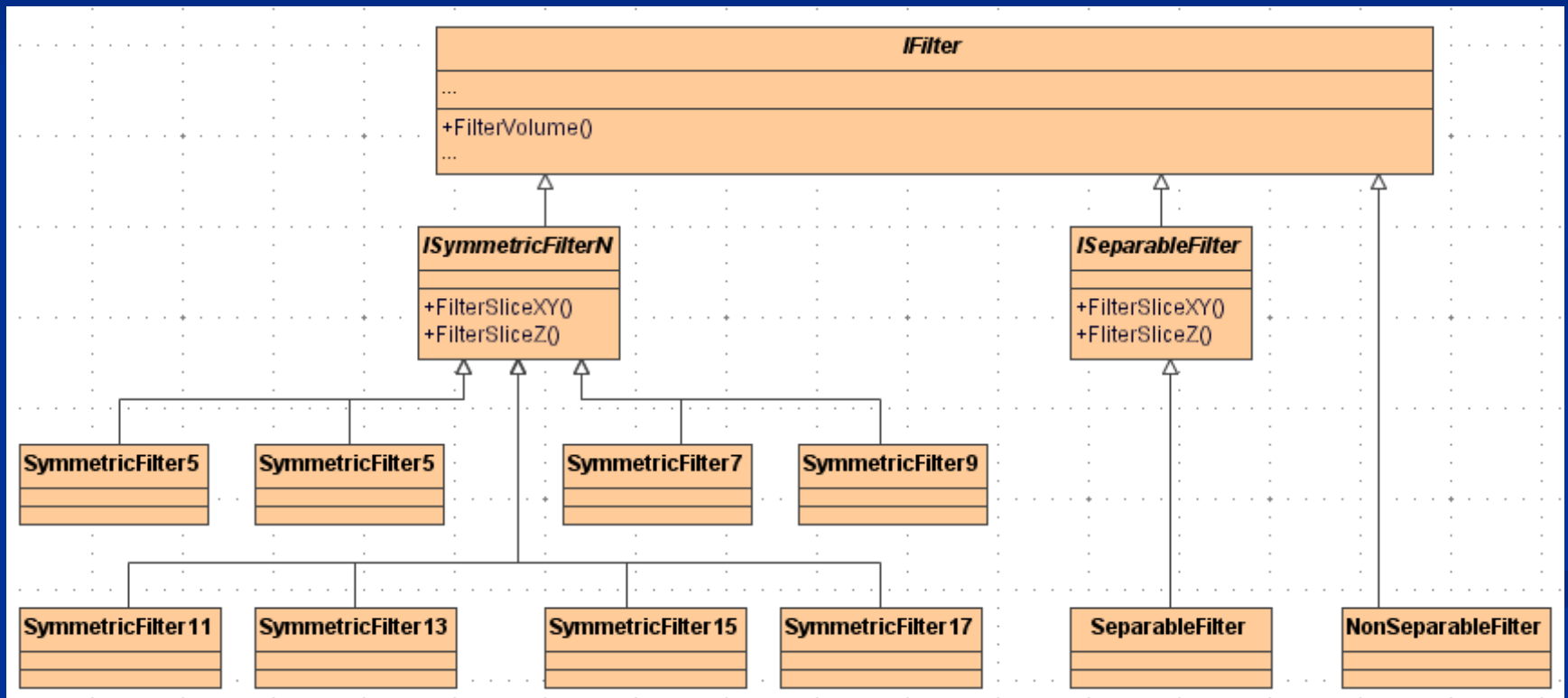
1. via f3dclass
- 2.
- 3.
4. direct use (through API)

Usage in f3dclass

- available methods:
 - generalConvolution/generalFilter
 - gaussFilter
 - gaborFilter (X/Y/Z)
 - generalSeparableFilter
- trunk – only with f3dSIMDRaster

Direct usage

- Domain model:



API (1)

- FilterVolume(float* volume, int nx, int ny, int nz, int padY, int padZ)
- Description:
 - inplace
 - padding required only for SymetricFilterN (at least $(N-1)/2$ lines/slices)

API (2)

- `FilterSliceXY(float* sliceIn, int nx, int ny, float* sliceOut)`
- Description:
 - may be inplace (`sliceIn==sliceOut`)
 - padding required only for `sliceOut` for `SymetricFilterN` (at least $(N-1)/2$ lines)

API (3)

- `FilterSliceZ(float** sliceXY, int nxy, float* sliceOut)`
- Description:
 - `sliceXY` must contain `dz` slices (`dz` – filter size in Z-direction)

Example

```
SeparableFilter filter;  
filter.SetOptLevel(OptLevelSSE);  
filter.PrepareKernels(kernelX,  
                    kernelY, kernelZ, dx, dy, dz);  
filter.FilterVolume(volume, nx, ny, nz,  
                  padY, padZ);
```

Restrictions

- volume width (nx) multiple of 4
- padding required (SymmetricFilterN only)
- alignment on 16-byte boundary (see align.h)
- single floating-point volumes (automatic conversion in f3dclass version6)

Future Work

- Filtering using FFTW into f3dFilter (Release 2)
- Filtering using CUDA into f3dFilter (Release 3)
- Filtering double precision FP volumes
 - SSE2 or higher required (Release 4)

Questions



**Thank you for your
attention !**

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