AARDVARK
Tensors & Images
or
How To Avoid Writing Loops

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The Generic Matrix Data Type

```c++
struct Matrix<T>
{
    T[] Data;
    MatrixInfo Info;
};

struct MatrixInfo
{
    long Origin; // 2
    V2l Size; // [3, 2]
    V2l Delta; // [1, 5]
    V2l First; // [-1, 0]
};
```
Properties of the Generic Matrix Data Type

- does not own the underlying data array: it is just a specific view of the data stored in the array (i.e. it is a Façade)
- can handle various different data layouts (row/column)
  - e.g.: a transposed version can easily be constructed by swapping the X- and Y- components of the Size, Delta, and First fields
- a sub-matrix is of the very same type
- the First field allows matrices with lowest coordinates that are different from \([0, 0]\), e.g. filters with are symmetrical about the origin
  - if this functionality is not used the First field is \([0, 0]\)
Other Tensors: Vector, Matrix, and Tensor4

Analogous construction to Matrix

- Vector<T>: long Size, Delta, First;
- Matrix<T>: V2l Size, Delta, First;
- Volume<T>: V3l Size, Delta, First;
- Tensor4<T>: V4l Size, Delta, First;
Default Memory Layout of Tensors

```
vol.ForeachZXY(  
    (z) => { }       // pre-plane action
    (z,y) => { }    // pre-line action
    (z,y,x,i) => {...vol[i]...} // element action
    (z,y) => { }    // post-line action
    (z) => { } );   // post-plane action
```
Matrix with different Data and View Types

```c++
struct Matrix<T>
{
    T[] Data;
    T this[long x, long y] { ... }
}

struct Matrix<TData, TView>
{
    TData[] Data;
    TVView this[long, long y] { ... }

    Func<TData[], long, TVView> Getter;
    Action<TData[], long, TVView> Setter;
}
```
class PixImage
{
    Col.Format Format; // enum, e.g. RGB, RGBA
}

class PixImage<T> : PixImage
{
    Volume<T> Volume; // T ... channel type
}
Default Layout of Image Volumes

- X, Y are natural image coordinates
- var matrix = image.GetChannel(Col.Channel.Red);
  gets a matrix referencing the red channel **without copying**
  - Delta.X = 3, cannot be directly used with Ippi methods
    use .ToImage() to obtain matrix that can be used with Ippi
Thank you for your attention!

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