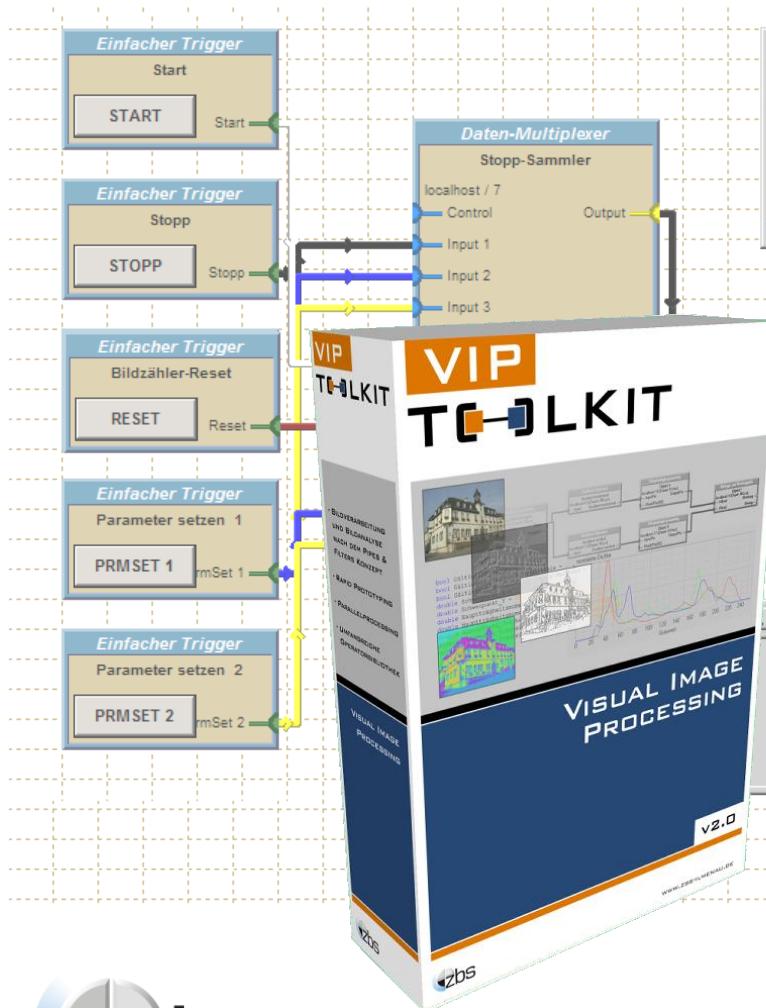


a powerful graphical developing tool for prototyping image processing tasks



PD Dr.-Ing. habil. Karl-Heinz Franke / Rico Nestler

Ilmenau Technical University
Faculty of Computer Science and Automation
Computer Graphics Group

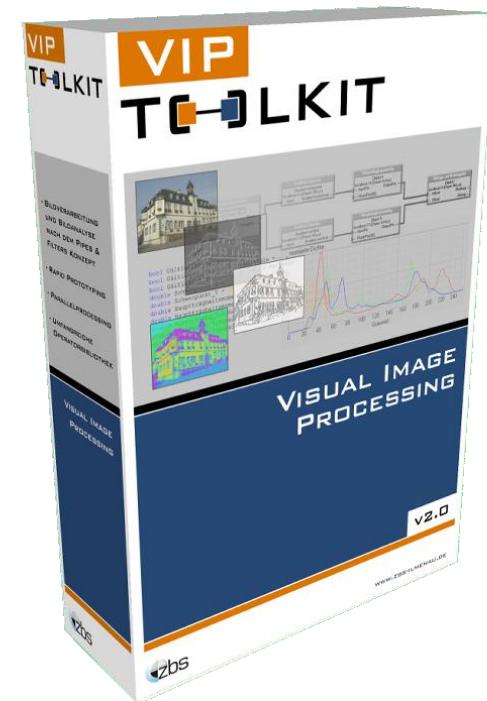
Zentrum für Bild- und Signalverarbeitung (ZBS) e.V.

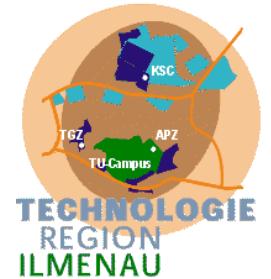
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-  - Introduction
-  - Overview
-  - Processing modules
- Application programming within 
- References / Examples
- Further informations





Historical root University of Technology Ilmenau with its former research group „Technische Erkennung“

Many years of experience in the field of image processing since **1978**

Founding of the **Zentrum für Bild- und Signalverarbeitung e.V.** in **1994**

Starting from 1995 with **3** employees

Founding of the **GBS mbH** as a subsidiary in **1997**

Since 1999 **10-12** employees

Long standing cooperations with regional and national companies and establishments, e.g.
Jenoptik LOS, ESW GmbH, Hommel-Werke Jena,
Wincor Nixdorf, Jena-Optronik GmbH, DLR Bonn,
Carl-Zeiss-Jena GmbH, Osram GmbH, ELTEC GmbH,
MAZeT GmbH, eZono GmbH, ...

...with research institutions and universities, among others Fraunhofer IOF, FSU Jena, Universität Bonn,
TU Ilmenau, ...

Society's activities:

- Pre-market research and development
- Transfer of fundamental academic research results into usable methods, prototypes and products for our customers
- Postgraduate education in several fields of image processing (www.visionexperts.de)
- Co-founder and member of the German Color Group (www.germancolorgroup.de)

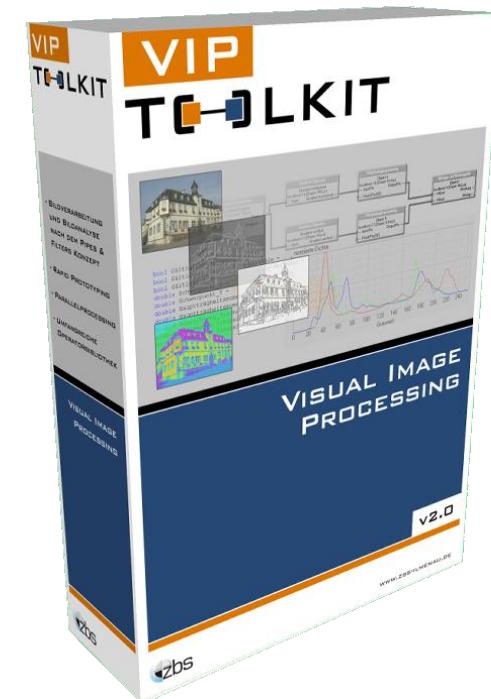


Areas of research:

- **Optimization of imaging systems & components:** Lens design
- **Multimodal image processing and analysis** from clearly defined environments up to complex scenes: Quality assurance, Outdoor applications, Remote sensing, Medicine
- **Image restoration:** Deconvolution, Scene reconstruction from image series
- **Colour and multichannel sensor signal processing:** Sensor design qualification, Spectral reconstruction from limited sensorial data
- **2D- and 3D-measurement and data processing:** White Light Interferometry, processing of focal series, Camera based 3D-monitoring and space surveillance

Visual Image Processing - Toolkit

- Sophisticated program package for rapid prototyping of image processing applications
 - Extensive library of algorithms
 - Modern graphical pipeline editor and custom user interfaces with **VIP™-Window**
 - Multiple programming approaches and execution modes
 - takes advantage of parallel processing and multicore systems
-
- Important and valuable tool
 - for engineers or scientists in many fields of applications and R&D
 - for graduate and postgraduate education



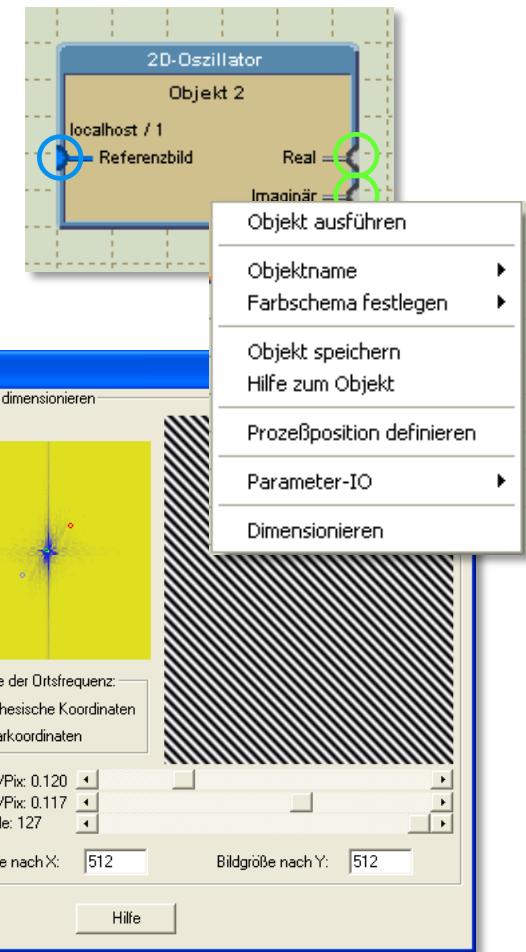
- More than **150** processing modules:
 - **image input-modules**, e.g. multidimensional image data input from cameras, frame grabbers, scanners or files, image stacks, most prevalent file formats are supported,
 - **image analysis- & image processing-modules**, e.g. image synthesis, arithmetic/geometric image manipulation, linear/nonlinear/morphologic filtering, color image processing, texture analysis, segmentation, generation of image based features, iconic/symbolic classification and image description
 - **modules that create or process non pictured data arguments**
 - **modules that control the data flow**, e.g. trigger, sequencer, timer, FIFO, multiplexer, recursion, data splitter/merger
 - **visualization-/output-modules**, e.g. for images, lists, tables, diagrams and symbolic results

The module library can be easily **extended according to the needs of customer applications !**



TOOLKIT - Processing Modules

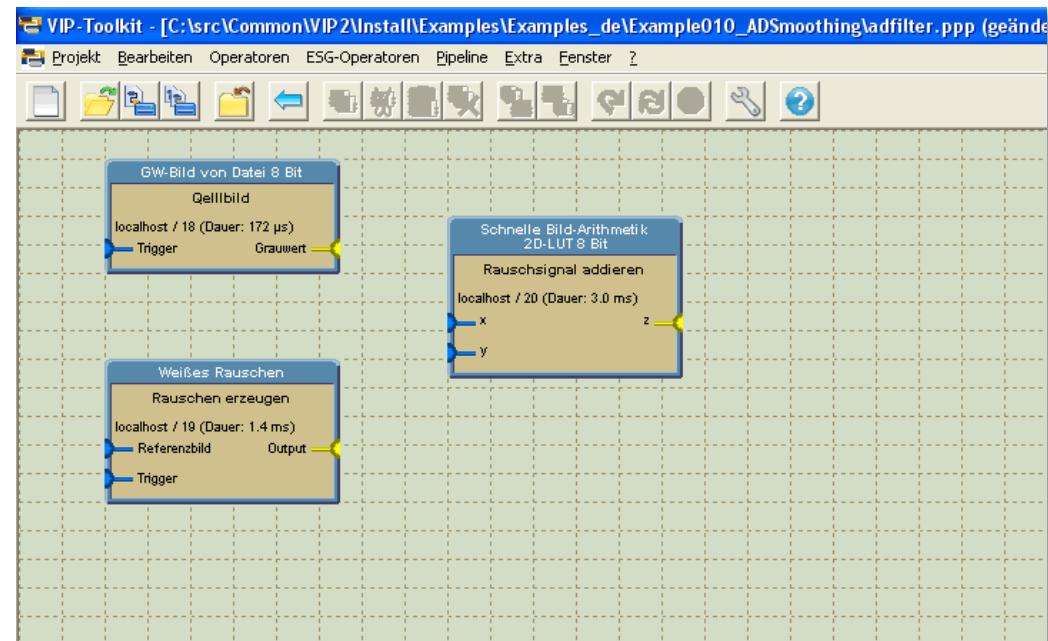
- Each module encapsulates image processing **algorithms of different complexity**
 - highly optimized very specialized operators
 - free programmable modules (C-like notation) for the realization of individual arithmetic or geometric operations
- Each module is equipped with a lot of functionality for **dimensioning a specific image processing task**
- Processing modules are **connected to processing pipelines**
- The module **inputs** and **outputs** are equipped with functionality for the **analysis of intermediate results**



TOOLKIT - Application programming

Rapid Prototyping with **VIP** **TOOLKIT**

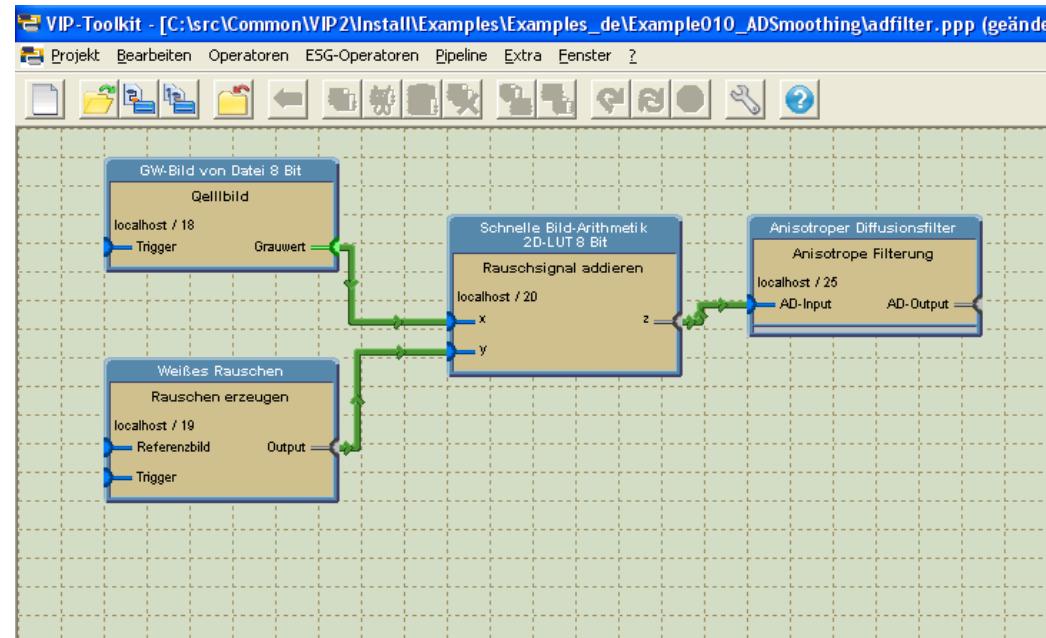
- place processing modules on the workspace



TOOLKIT - Application programming

Rapid Prototyping with **VIP TOOLKIT** means design a processing pipeline **graphical** step by step.

- place processing modules on the workspace
- connect processing modules to pipelines
- use default module parameters or use parameters based on prior knowledge

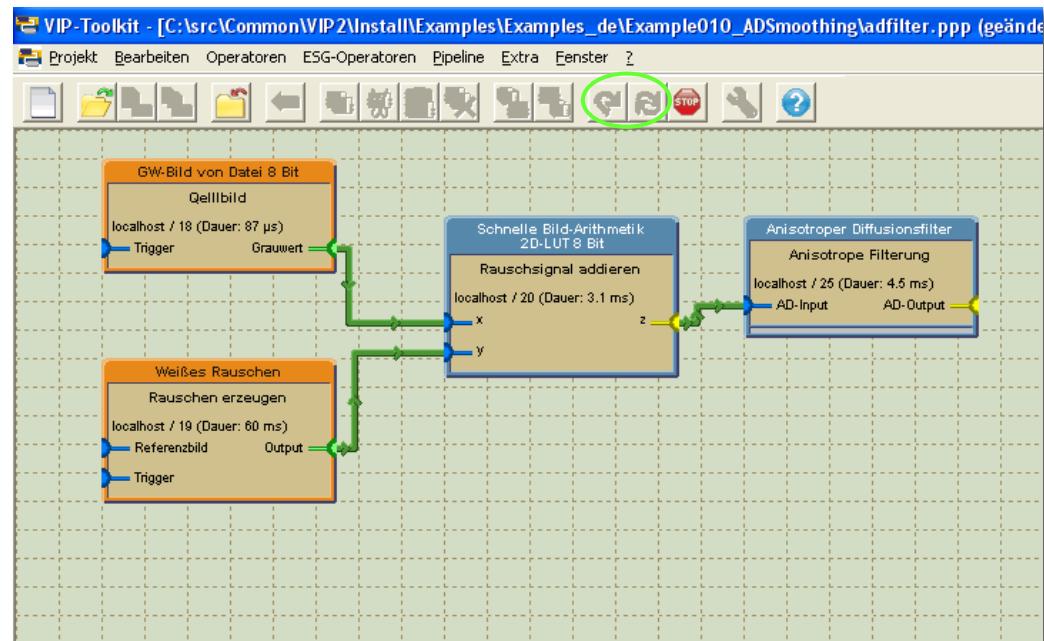


TOOLKIT - Application programming

TM

Rapid Prototyping with **VIP TOOLKIT** means design a processing pipeline **graphical** step by step.

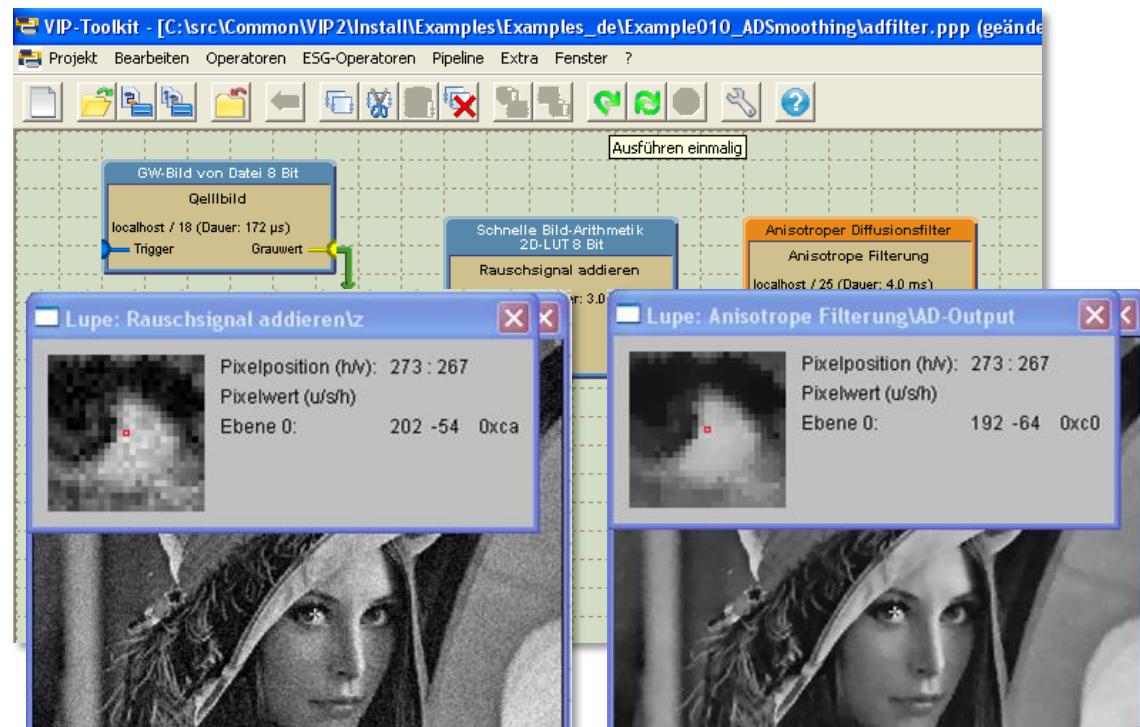
- place processing modules on the workspace
- connect processing modules to pipelines
- use default module parameters or use parameters based on prior knowledge
- execute the pipeline



TOOLKIT - Application programming

Rapid Prototyping with **VIP TOOLKIT** means design a processing pipeline **graphical** step by step.

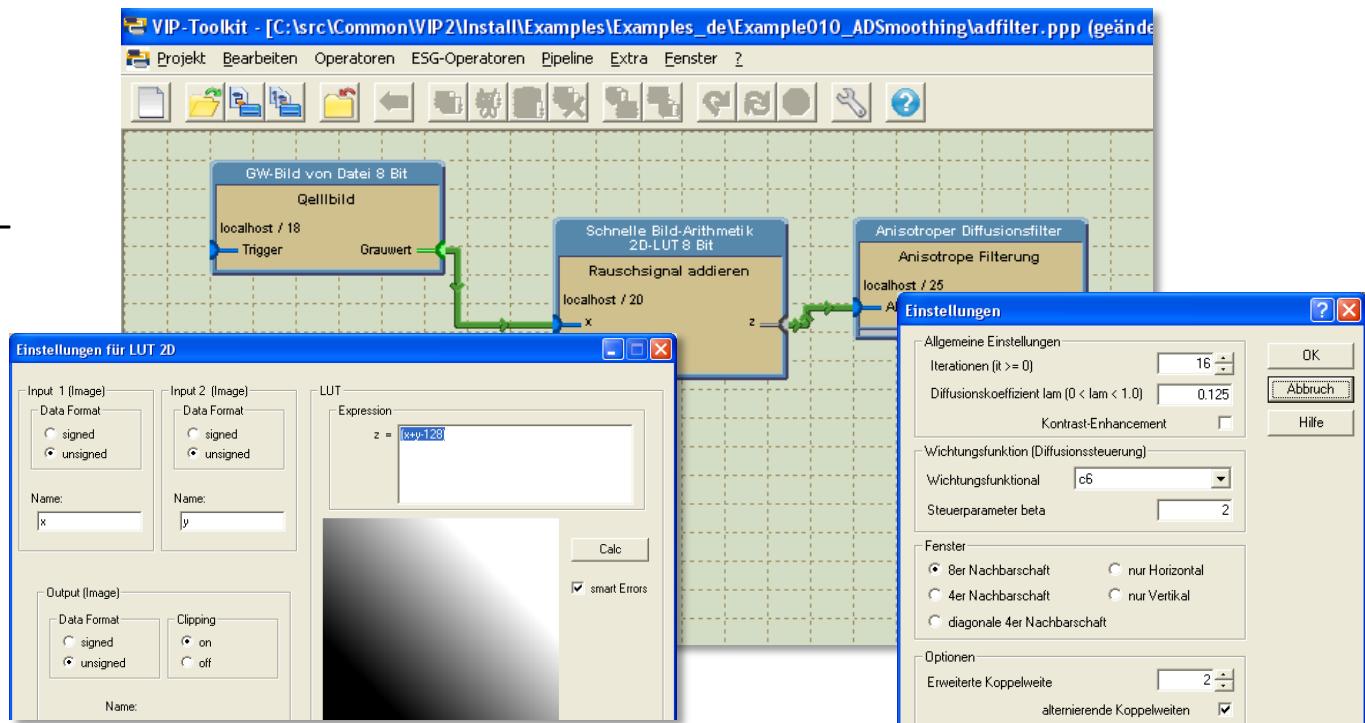
- place processing modules on the workspace
- connect processing modules to pipelines
- use default module parameters or use parameters based on prior knowledge
- execute the pipeline
- examine intermediate and final results



VIP TOOLKIT - Application programming

Rapid Prototyping with **VIP TOOLKIT** means design a processing pipeline **graphical** step by step.

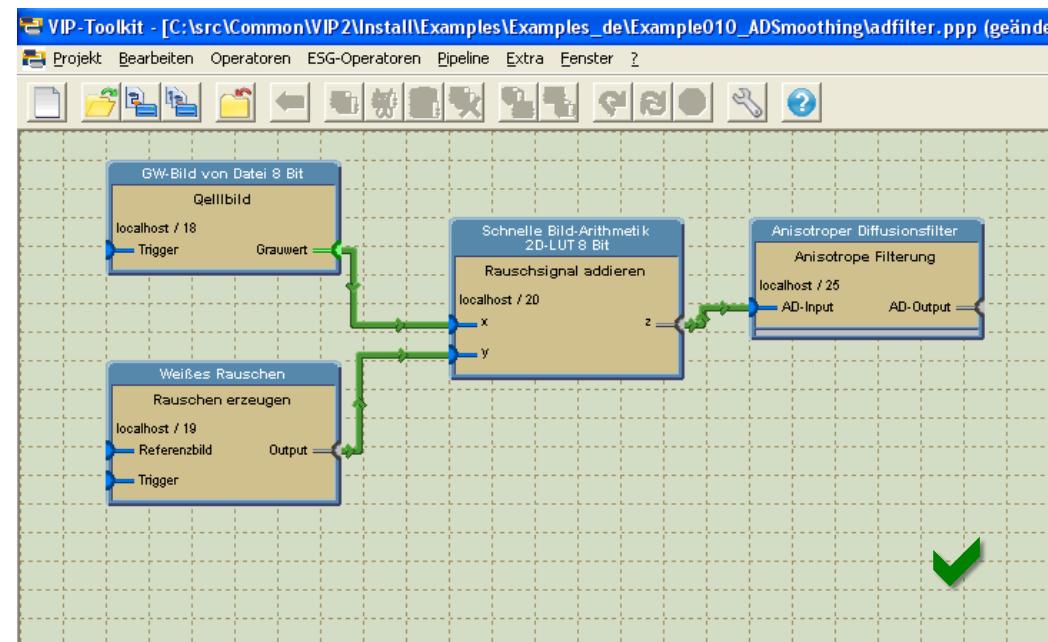
- place processing modules on the workspace
- connect processing modules to pipelines
- use default module parameters or use parameters based on prior knowledge
- execute the pipeline
- examine intermediate and final results
- refine the module parametrization or modify the pipeline



TOOLKIT - Application programming

Rapid Prototyping with **VIP TOOLKIT** means design a processing pipeline **graphical** step by step.

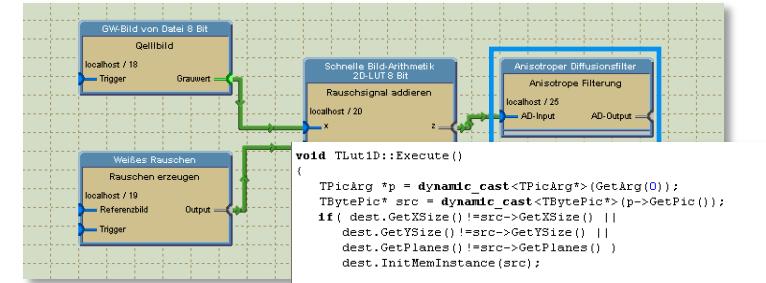
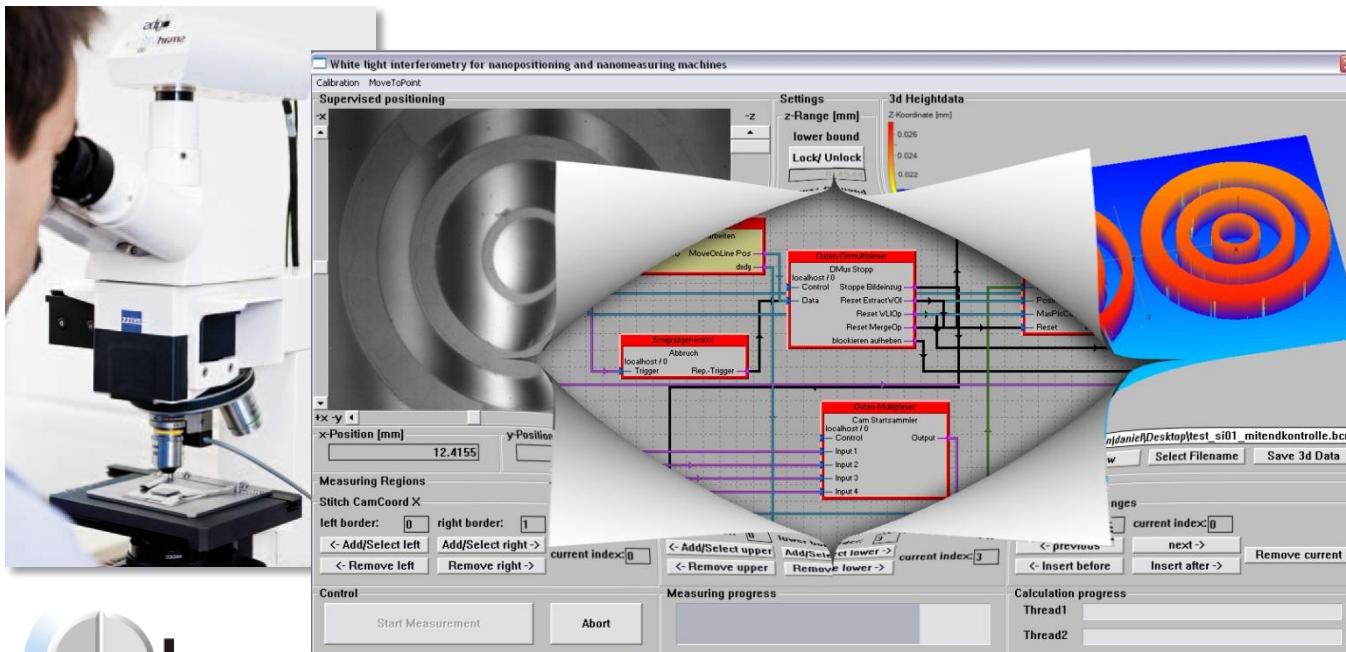
- place processing modules on the workspace
- connect processing modules to pipelines
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TOOLKIT - Application programming

Utilize thus prototyped solutions by

- building individual user interfaces with VIP™-Window
- separating **module algorithms** and their parametrisation to use on the target platform, such as algorithm descriptions or DLL's



```
void TLut1D::Execute()
{
    TPicArg * p = dynamic_cast<TPicArg*>(GetArg(0));
    TBytePic* src = dynamic_cast<TBytePic*>(p->GetPic());
    if( dest.GetXSize() !=src->GetXSize() ||
        dest.GetYSize() !=src->GetYSize() ||
        dest.GetPlanes() !=src->GetPlanes() )
        dest.InitMemInstance(src);

    char errstr[256];
    if( !CheckNVInput(errstr) )
    {
        Error(ertstr);
        return;
    }

    // geänderte NV-Listen - Parameter ? -> neu compilieren
    if( ScanNVList() || must_calc_lut )
        Calclut();

    state_LUT.LockRecurciv(false);
    uint8 const *lut = state_LUT.GetDataPtr();

    for (int32 plane=0; plane<dest.GetPlanes(); plane++)
    {
        for (int32 y=0; y<dest.GetYSize(); y++)
        {
            uint8 *dp = dest.Data3D[plane][y];
            int32 x = dest.GetXSize();

            memcpy(dp,src->Data3D[plane][y],x);

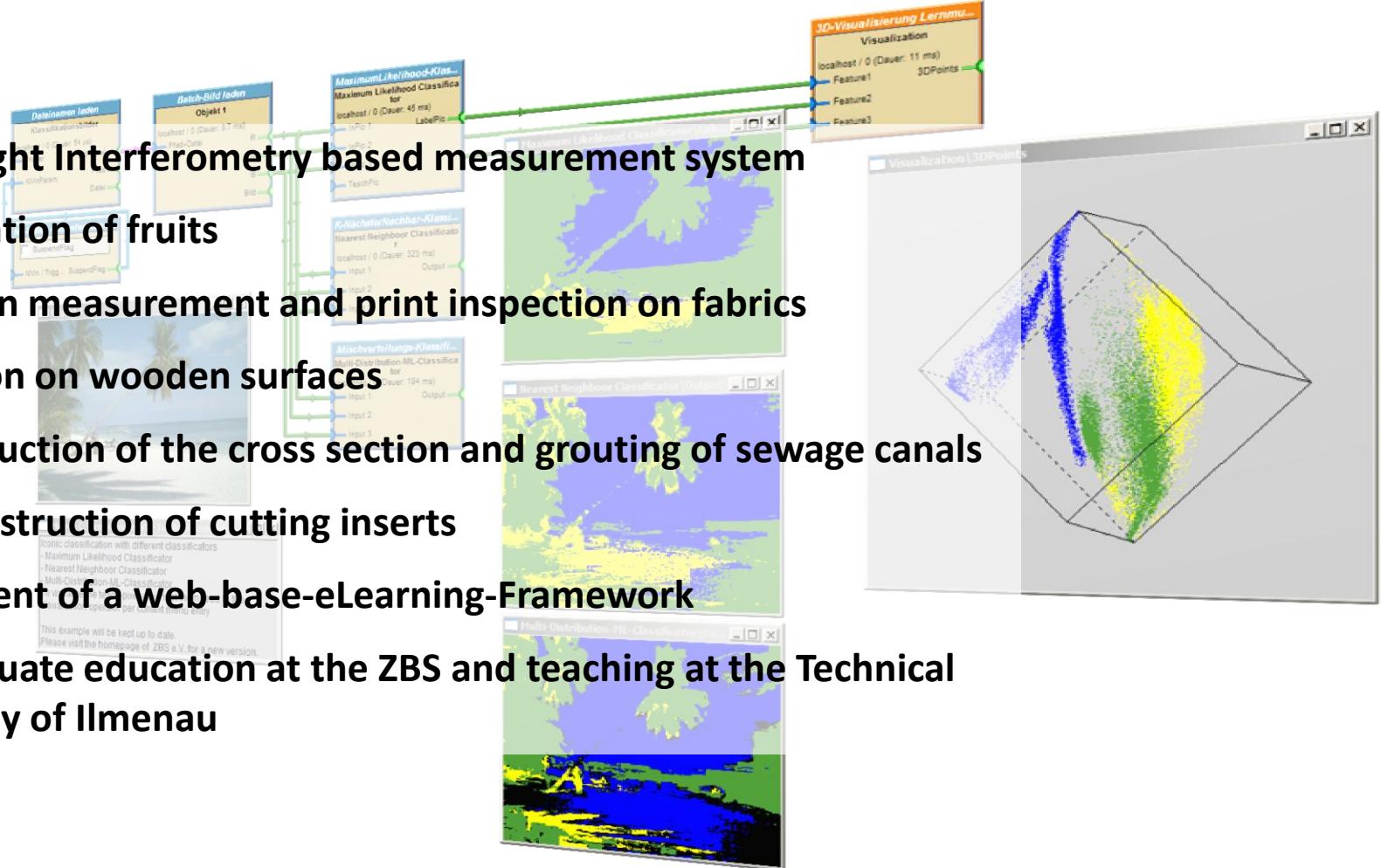
            do
                *dp++ = lut[*dp];
            while (--x);
        }
    }

    state_LUT.UnLockRecurciv();
    dest.SetOffs(src->GetXOffs(), src->GetYOffs());
    GetOutput(0)->SetStatus(TOutput::OK);

    if (prop_NVListOutput.GetBool())
    {
        GetOutput(1)->SetStatus(TOutput::OK);
    }
}
```



- White Light Interferometry based measurement system
- Classification of fruits
- Distortion measurement and print inspection on fabrics
- Inspection on wooden surfaces
- Reconstruction of the cross section and grouting of sewage canals
- 3D reconstruction of cutting inserts
- Component of a web-base-eLearning-Framework
- Postgraduate education at the ZBS and teaching at the Technical University of Ilmenau



TOOLKIT - References / Examples

Object segmentation as part of a nut sorting system:

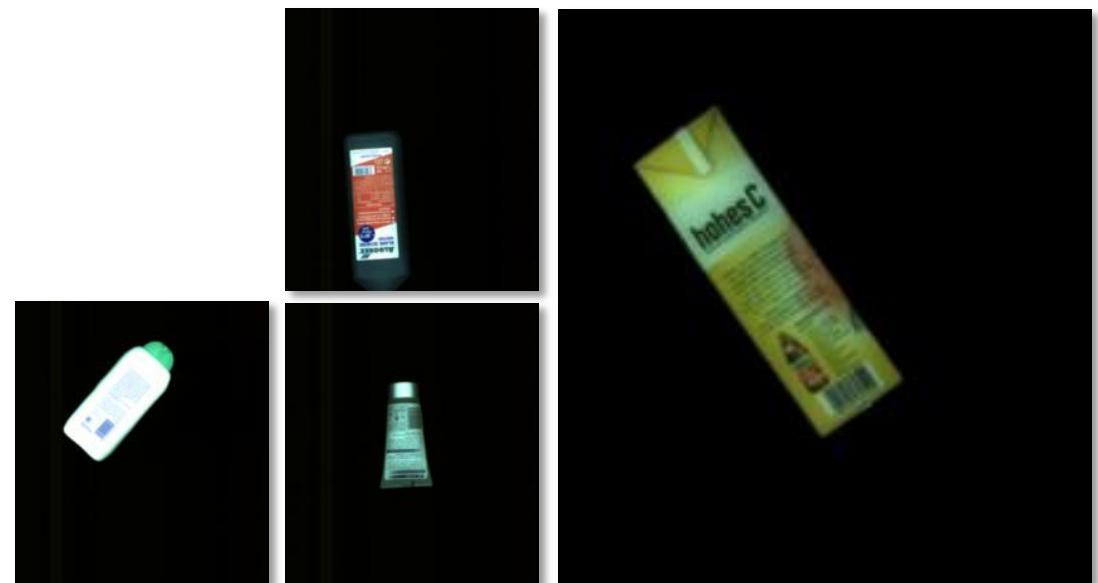
- decay, mould (aflatoxins), insect bites
- free fall omnidirectional inspection
- high throughput, parallel processing, up to 20 inspection channels



→ VIP™
TOOLKIT

Object classification as part of a self checkout system:

- vast and variable size of objects (classes)
- high dimensional feature vectors
- invariant integral object features (position, rotation, view, pose)
- statistical classification
- high performance

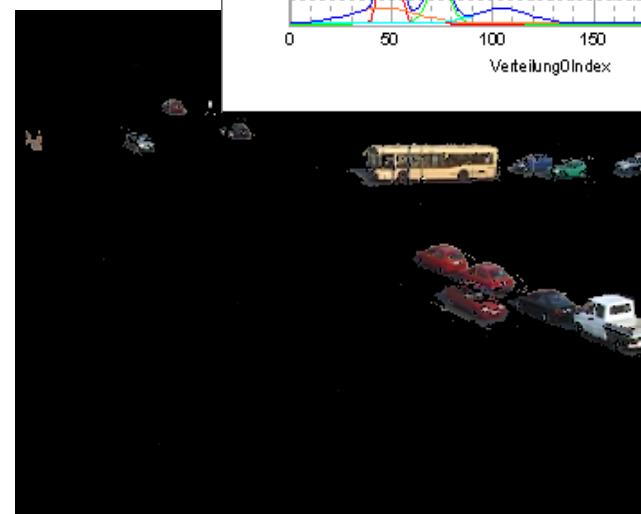


Foreground-/Background pixel classification as part of a system for camera based traffic surveillance:

- background modelling by multiple gaussian
- robust segmentation of stagnant and moving objects (pedestrian, cars)
- object classification
- road flow analysis



VIP™
TOOLKIT



Further informations

Further informations about our activities: www.zbs-ilmenau.de



www.zbs-ilmenau.de/vip/

- **60 days** evaluation period
- tutorial plus extensive number of examples
- Windows 7/Vista/XP SP2/2000/NT4.0 (32 or 64-bit)
- 2 GB of RAM
- 25 GB of free disk space

Any questions ? rico.nestler@tu-ilmenau.de !

