

# Open Inventor Medical Edition

## 3D graphics and image processing software for application developers

Thermo Scientific™ Open Inventor™ Medical Edition is a software development toolkit (SDK) that provides state-of-the-art 3D graphics, image processing and visualization features for medical, dental, and research applications. Open Inventor supports developers using C++, .NET or Java and applications can be deployed in both desktop and cloud environments. Its easy-to-use API, extensible architecture, and large set of advanced built-in components provide developers with a high-level platform for integrating visualization capabilities into software applications in a simple and consistent way.

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SCIENTIFIC

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## Power your software development with Open Inventor Medical Edition

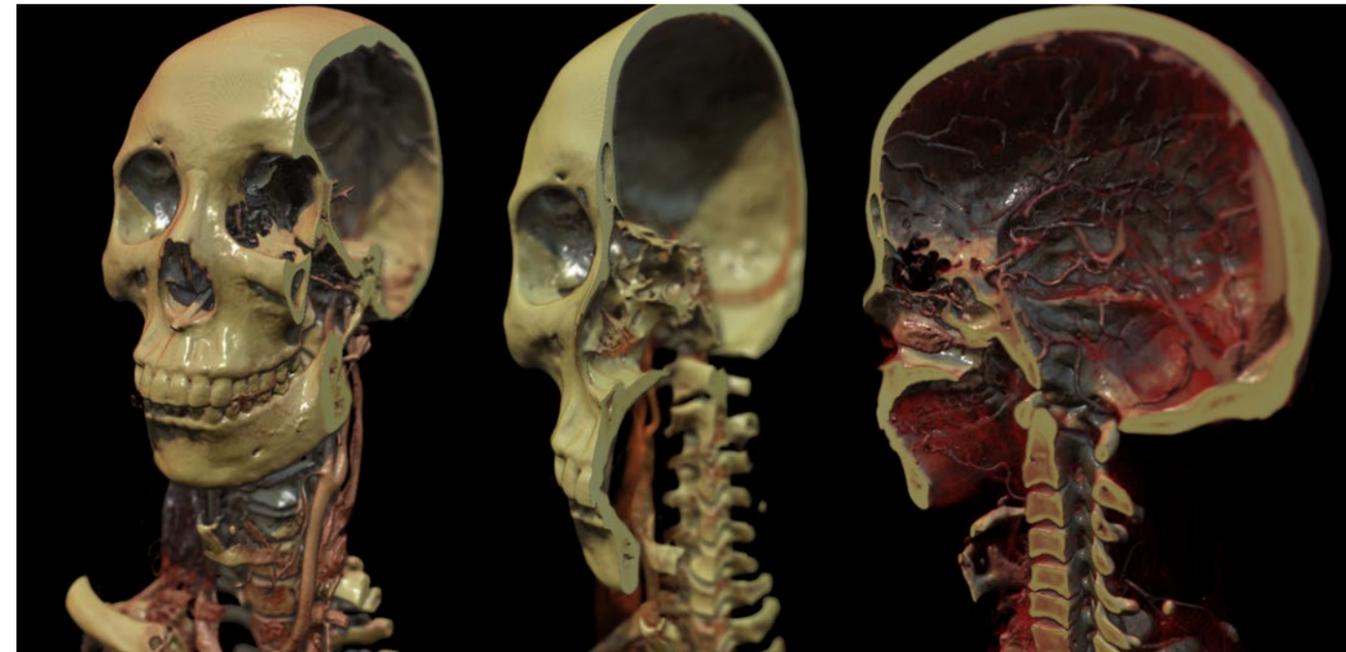
Open Inventor Medical Edition is a cross-platform software development toolkit (SDK) for implementing commercial and research applications with 2D and 3D image computing workflows in medical and dental markets. Based on the widely used Open Inventor 3D toolkit, this edition provides high-level image visualization, processing and analysis through an object-oriented API.

Whether you are an independent software vendor or a hardware vendor, Open Inventor Medical Edition gets your software to market faster, with superior images and performance. Partnering with the visualization experts at Thermo Fisher Scientific means that your in-house developers can focus on their domain specific expertise.

3D rendering is now practical for any application, whether it's a new development or an upgrade, and Open Inventor makes it easy to add this extra dimension. The speed and capacity of modern graphics processing units (GPU) allow Open Inventor to provide better performance and quality than CPU-based renderers and to seamlessly mix image rendering with geometry including CAD data.

Remote visualization allows your end-users to be at one machine while the application and the 3D rendering run on a rendering server located anywhere on the network or in the cloud. End-users do not need any 3D hardware or client software, just an HTML5-enabled web browser.

Industry leading algorithms for image enhancement, segmentation, analysis and quantification allow your end-users to work faster and smarter than ever before. Segmented objects can be converted to geometry and exported for use with simulation tools and 3D printing.



### Go to market faster

- Object-oriented API and components
- Develop in C++, .NET or Java
- Advanced debugging and productivity tools
- Easy integration with existing applications

### Deliver state-of-the-art 3D

- High performance and high image quality
- State-of-the-art volume rendering
- Advanced image processing and analysis
- Advanced support of meshes and grids

### Solve tough 3D challenges

- Cloud/mobile remote visualization
- Fusion of multiple data types
- Very large data sets management

### Increase productivity

- Programming examples and tutorials
- Clear and thorough documentation
- On-site training
- Prompt, effective support hotline

### Reduce maintenance costs

- Professional consulting
- Professional services (custom development)
- Active user community
- Flexible licensing model

## About Open Inventor Medical Edition

Open Inventor Medical Edition provides the tools you need to build visualization and image processing applications with state-of-the-art features and performance.

### Image and volume data

Open Inventor can load images, volumes or stacks of images from DICOM and other standard formats. Data can be rendered using slices, multiplanar reconstruction (MPR), curved MPR, slab MPR, shaded surface (SSD) and direct volume rendering (DVR). Modern GPUs are massively parallel multi-core processors that allow off-loading computational tasks from a computer's CPU. Open Inventor uses the GPU to render high quality images at interactive speed. Slices can be arbitrarily aligned, curved or defined by any geometric surface. Isosurfaces (SSD) are rendered directly from the image data, allowing the threshold value to be modified interactively. Volume rendering uses the GPU to do physically correct ray-casting in real time with multiple light sources, shadowing and material properties. Rendering parameters such as window level, color and opacity can be modified instantly. Multiple volumes from the same or different modalities can be rendered in the same scene (data fusion).

### Geometry

Open Inventor supports 3D geometry including points, markers, lines, polygons and NURBS surfaces. Open Inventor can import CAD data including Catia, Parasolid, SolidEdge and STEP. This allows geometry such as implants, prostheses and medical devices to be mixed with image data for surgical planning, simulation and training applications.

### Mesh data

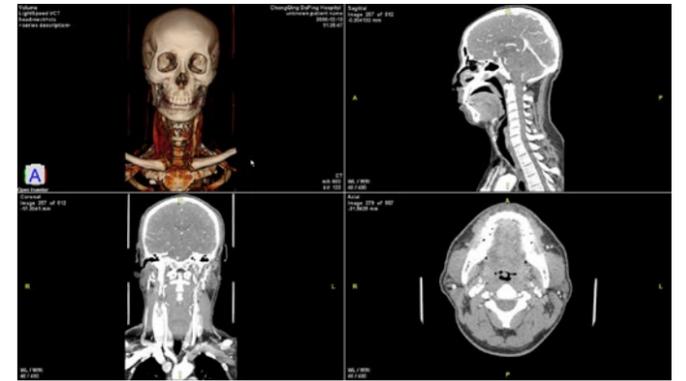
Open Inventor supports geometry such as triangle surface mesh and tetrahedron volume mesh. Scalar and vector data sets can be visualized on a mesh using color mapping, contouring, vector glyphs and streamlines. This allows data generated by external simulation tools using FEA or CFD methods to be displayed together with the image data.

### Interaction

Open Inventor supports mouse and keyboard input as well as touch, swipe and gesture based input techniques. Open Inventor also provides 3D interaction tools that allow users to directly manipulate objects in the scene, such as slices and clip planes, by clicking and dragging.

### Virtual and Augmented Reality (VR/AR)

Open Inventor provides the same high quality rendering and interaction features in head-mounted display (HMD) devices such as Oculus Rift and HTC Vive. VR and AR enable new opportunities in education, training and assisted surgery.



### Annotation and measurement

Open Inventor can easily create 2D and 3D annotations using markers, lines, curves, rectangles, ellipses, polygons and text. Screen drawing tools allow users to interactively define annotations and measurements. High level tools are also provided for 2D and 3D axes, graphs and charts.

### Image processing

Open Inventor provides image enhancement, segmentation, analysis and quantification tools that can be applied to both 2D and 3D image data. Image enhancement includes many sharpening, smoothing and denoising filters in the intensity domain and the frequency domain (FFT). Segmentation tools include intensity (thresholding and watershed), edge and region based algorithms. Image analysis and quantification can compute statistics such as area, volume, number of objects and more. Segmentation and virtual resection can also be done in the spatial domain using powerful tools including region of interest, clipping planes, clipping geometry (volume sculpting) and mask volumes.

### Export

Open Inventor can export geometry directly to STL format for 3D printing. Open Inventor can also render very high resolution images, at any size, for posters and publications.

### Remote rendering

Open Inventor can also provide these image visualization, processing and analysis features as a web service. While the actual data remains secure on the server, users can access the resulting 2D and 3D visualizations anywhere, on any device, using any HTML5 browser. No 3D hardware is required on the client side, multiple users can connect and collaborate in the same session and multi-touch and gesture input is fully supported. This is well suited for both in-house and cloud-based applications, including upgrading PACS viewers to 3D.

**Integrate high-performance 3D visualization into your software applications**

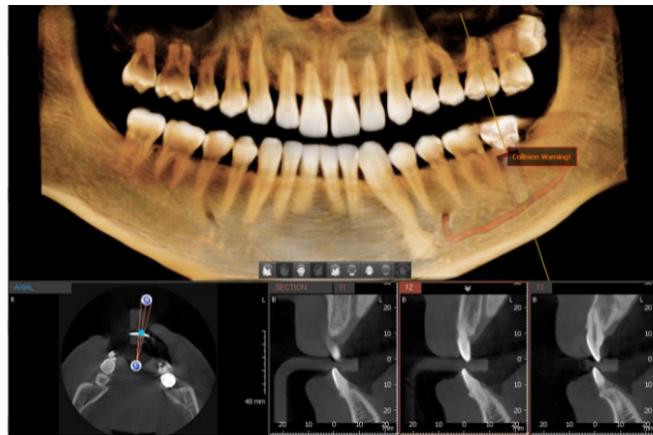
Developers of both commercial and internal software applications can leverage Open Inventor Medical Edition for integrating advanced 2D/3D visualization and image processing into their applications. Just a few of the many organizations using Open Inventor Medical Edition are: SYAC, Ewoosoft, Olea, spontech, iGene, Imricor, Zuse Institute Berlin (ZIB), and the Hannover Medical School.

**Ewoosoft**

Ewoosoft is a world leading provider of dental diagnostic imaging software and solutions, and a subsidiary of Vatech, the global leader in digital dental X-ray. Ewoosoft is using Open Inventor as the core 3D visualization component for their Ez3D-i dental software.

Ez3D-i is a 3D imaging viewer which allows dentists to quickly and accurately diagnose their patients. Its capabilities include 3D visual simulation, 2D image analysis, and various ways of manipulating CT images through a variety of MPR functions. Ez3D-i takes advantage of Open Inventor to provide advanced 3D rendering and simulation features, and also allows for easy integration with other software, for example surgical guide applications for implant placement. Ez3D-i has raised the bar for advanced features such as accurate collision detection and 3D panorama. "We are very happy to choose Open Inventor as the 3D core engine. Thanks to the comprehensive features of Open Inventor, we could focus more on which features to provide to our customers rather than how." Ike Kim, CTO at Ewoosoft.

[ewoosoft.com](http://ewoosoft.com)



Collision detection between implant and canal. Courtesy of Ewoosoft.

**iGene**

iGene, an Infovalley company, develops iDASS™ software that employs images from medical imaging modalities, mostly CT scanner, to produce a 3D digital body for forensic autopsy. Powered by Open Inventor's advanced volume rendering technology, iDASS is the first application in the forensic domain that enables pathologists to investigate the human body without physically manipulating it. High-quality interactive 3D rendering integrated into a complete virtual autopsy environment allows forensic pathologists to examine digital representations of real bodies.

[digitalautopsy.co.uk](http://digitalautopsy.co.uk)



3D volume rendering of internal organs of a cadaver. Courtesy of iGene Sdn. Bhd.



iDASSmart LCD Screen for digital examinations. Courtesy of iGene Sdn. Bhd.

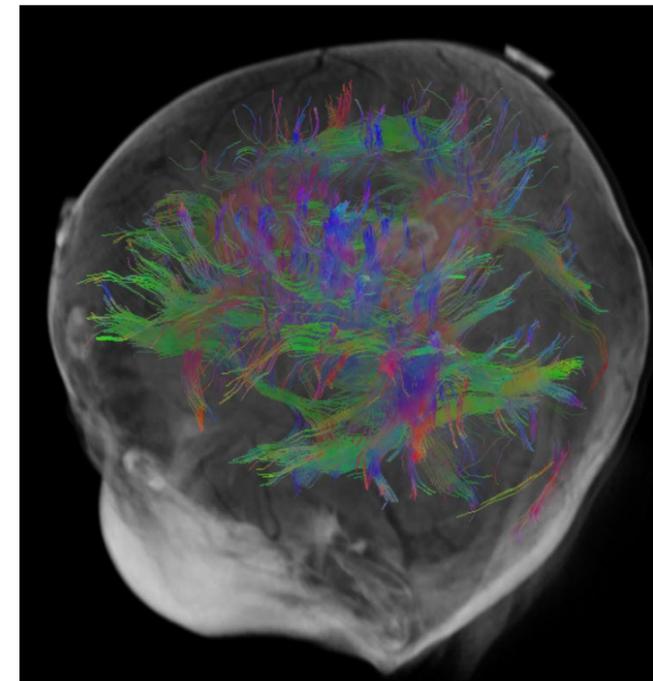
**Olea Medical**

Olea Medical is the provider of Olea Sphere®, an innovative post-processing software suite for MR and CT perfusion imaging. Olea Sphere® is a multi-vendor post-processing solution that significantly speeds up the diagnosis process and makes the evaluation of several pathologies much easier - from neuro diseases to breast cancers to musculo-skeletal disorders.

Olea Medical launched a new version of its viewer, Olea Vision™, which now uses Open Inventor for enhanced 3D volume rendering. Open Inventor also adds an extensive set of algorithms to Olea Sphere®'s existing capabilities, such as Diffusion Tensor Imaging (DTI) rendering, Maximum and Minimum Intensity Projection (MIP and MinIP), and advanced transparency.

"Using Open Inventor came as an evidence when we decided to change our 3D rendering engine. Indeed, this rendering has the best integration with Java, which was mandatory for us", says Olea Medical's CTO, Cyril Di Grandi. "Furthermore, the rendering performance is high, and memory management is fast and effective. The amazing quality and availability of the technical support was the icing on the cake."

[olea-medical.com](http://olea-medical.com)



Diffusion Tensor Imaging (DTI) rendered through Open Inventor in Olea Sphere. Courtesy of Olea Medical.

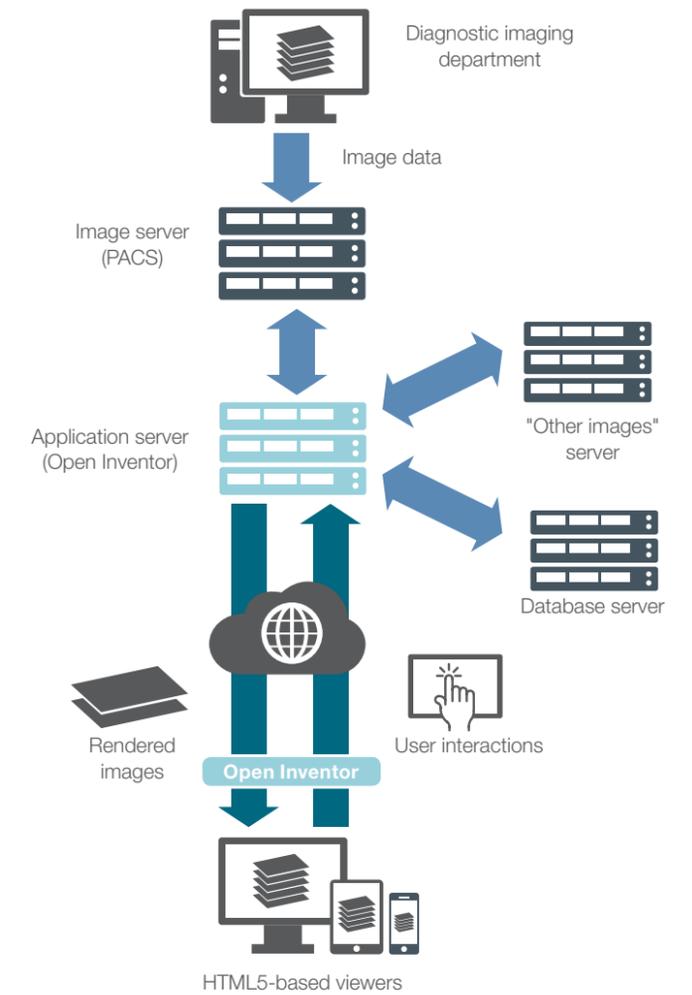
**SYAC**

Sistemas y Asesorías de Colombia S.A. (SYAC) is the leading software application development company for the public and private health sector in Colombia. SYAC provides Dinámica Gerencial Hospitalaria, a hospital information system that allows healthcare professionals to concisely evaluate 2D and 3D images that are stored in a PACS, regardless of the PACS supplier.

Using Open Inventor's 2D and 3D remote rendering capabilities, SYAC is developing an optimized web-based version of Dinámica Gerencial Hospitalaria, allowing a seamless workflow from the radiologist to the doctor.

"We found in Open Inventor a tool that met all our expectations for developing our web-based 2D and 3D analysis software. And beyond the tool, a professional, experienced and committed team of people that facilitated a very good partnership, which enabled us to develop our project and quickly achieve the expected results." Ricardo Pinzón Díaz, CEO at SYAC.

[syac.net.co](http://syac.net.co)



Project workflow of the web-based HIS by SYAC.

### Why use Open Inventor Medical Edition

Open Inventor's advanced visualization features are based on treating the data as a 3D volume and taking advantage of the massively parallel computing power of the graphics processing unit (GPU). Operations like MPR, that can be time consuming when working with a classic "stack of images," can be done in real-time on the GPU.

### Slice rendering

Open Inventor supports planar slices with any orientation, plus slices can have any shape, e.g. a curved surface, defined by application supplied geometry. Slices can also have thickness and be displayed in 2D using (for example) MIP or be displayed in 3D as a "slab". GPU rendering also allows multi-sample interpolation which gives better image quality than simple linear interpolation.

### Surface rendering

Using the GPU, Open Inventor is able to render surfaces (SSD) directly from the image data, without the need to extract triangles. This allows the threshold value to be modified interactively, making isosurface a powerful tool for exploring volume data. Open Inventor can render multiple isosurfaces simultaneously, each with its own color and transparency, as shown below. It is also possible to extract the actual triangles and export this geometry.



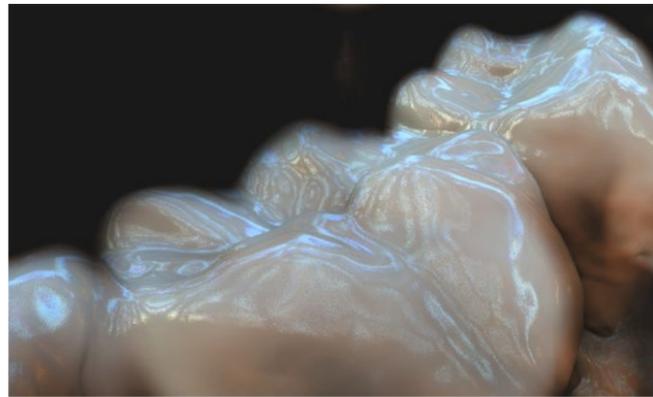
Multiple isosurfaces with correct transparency.

### Volume rendering

Volume rendering is implemented using physically correct ray-casting with multiple light sources, shadowing and material properties. Very high performance is possible using the huge number of compute cores available on the GPU to process many rays in parallel. This allows rendering parameters such as window level, color and opacity to be modified interactively even for large data sets.

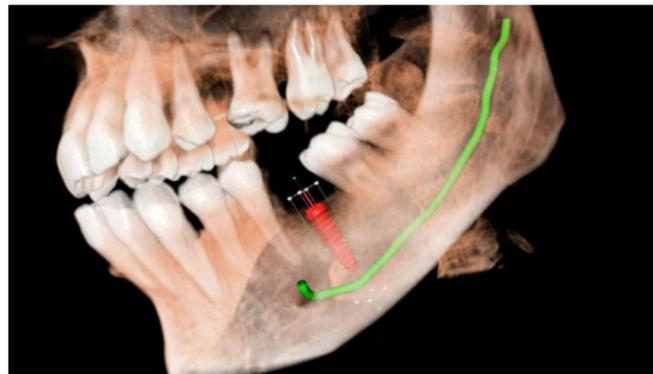
Open Inventor state-of-the-art volume rendering includes "cinematic" effects like depth of field, ambient occlusion (simulated global illumination), environmental lighting from real world images and physics based shading (realistic materials based on physical properties).

This more physically accurate presentation of the structures in your volume data has tremendous benefits for imaging tasks including surgery planning, implant planning, patient communication, and education.



Dental visualization using Open Inventor physically based shading.

The highly configurable rendering pipeline handles complex combinations of data. Multiple volumes from the same or different modalities can be rendered in the same scene (data fusion). Volume masks can be used to apply different transfer functions to different regions of the volume. Volume data and geometry can be rendered together with correct transparency.



Co-visualization of 3D CBCT and CAD models.

The rendering pipeline also allows advanced developers to create custom "shader" functions that run on the GPU. These functions can be used to implement proprietary coloring, blending, masking and displacement algorithms.



Custom flattening shader for panoramic projection.

Designed with input from our most demanding customers to allow rapid application development, Open Inventor Medical Edition rendering tools are easy to learn and integrate quickly into your development process. Your developers can focus more on their domain specific expertise and bring effective solutions to market faster.

### Advanced image processing and analysis

Open Inventor provides more than 300 image enhancement, segmentation and analysis tools for implementing medical image computing workflows. These tools have been optimized over more than 20 years by in-house image processing experts, who continue to add new and improved algorithms.

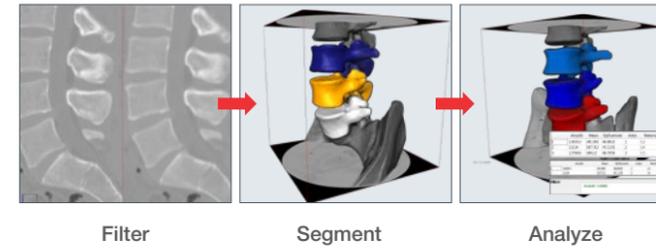


Image processing includes enhancement tools like sharpening, smoothing and edge detection, but also morphology operators, FFT and distance maps. Open Inventor supports both manual and automated segmentation using tools like adaptive thresholding, watershed and hole filling. Image analysis tools for quantification compute measurements about the segmented data like number, area and volume of objects. Custom measurements can be defined by the application. Image processing tools can be linked together to create processing pipelines. These pipelines can be saved and re-applied to new data sets.



Segmented objects can be converted to geometry and exported directly to STL format for 3D printing.

### Interactive remote visualization

Remote visualization allows your end-user to work anywhere with network access while your data remains secure and your application runs on a server located anywhere on your network or in the Cloud. The visualization and image processing power of Open Inventor is available to the application as a web service and Open Inventor efficiently transmits rendered images to the display device(s) and notifies the application of events resulting from the user interactions.

End-users do not need any client software, only an HTML5 web browser. Multiple users can connect to the same server, working independently or sharing a session for collaboration. Users can interact with the application using touch and gestures in addition to traditional input devices.

Remote visualization allows you to add resources on the network to handle growing data and to provide users with more advanced visualization and analysis. Use Open Inventor to add 3D to your web-based application or to evolve your desktop application to web-based access.

### Virtual Reality and Augmented Reality

Scientists and doctors are used to visualizing data on a computer monitor. Virtual Reality (VR) provides a way to enter a virtual world and get inside your 3D data. While Augmented Reality (AR) allows you to see your data and the real world at the same time. The visualization and image processing power of Open Inventor is available in head-mounted displays (HMD), such as Oculus Rift and HTC Vive, that make these capabilities available for your application.

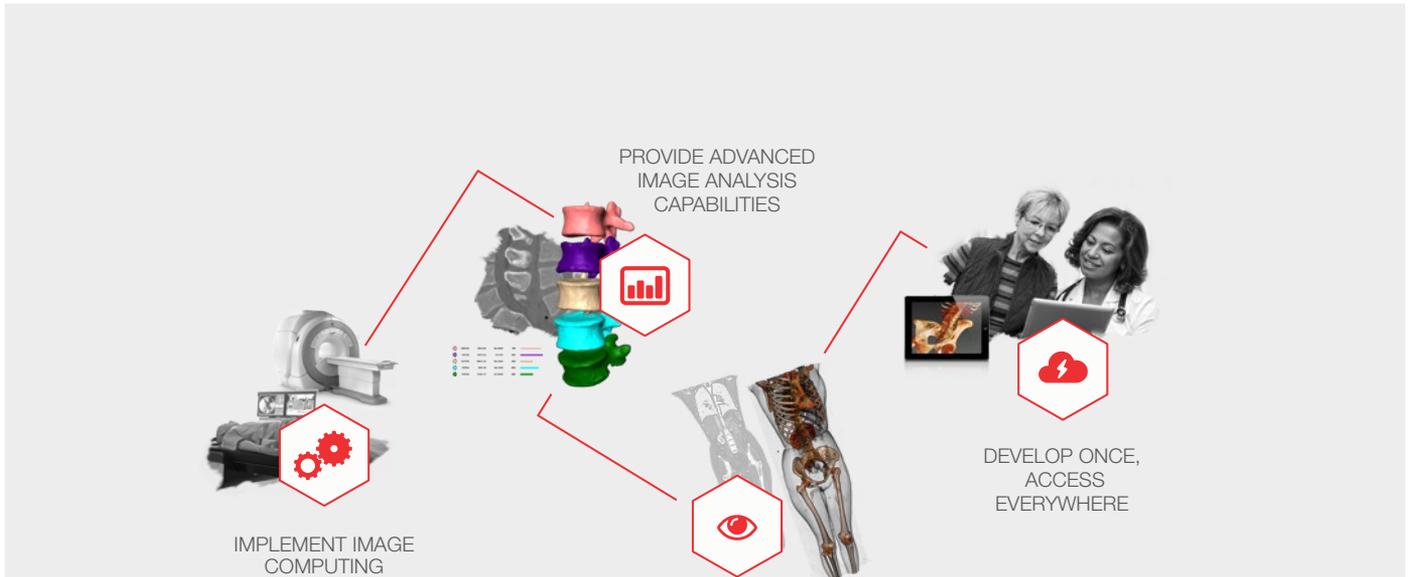
VR/AR users can experience the same high quality Open Inventor volume rendering (and other visualization) as desktop and remote visualization users. Developers will appreciate being able to re-use the same Open Inventor rendering code for desktop, cloud and VR/AR applications.

Open Inventor supports head tracking, input device tracking and VR/AR interaction techniques. This allows developers to create applications for education, training, computer assisted surgery and more.



Smooth head tracking with an Open Inventor-based application.

# Power your software development with Open Inventor Medical Edition



## Deliver state-of-the-art 3D

Open Inventor Medical Edition provides the power and functionality of 3D visualization at an object-oriented level. The easy-to-use API, extensible architecture, and large set of advanced components provide software developers with a high-level platform for rapid prototyping and development of advanced 3D graphics applications.

Open Inventor also provides specialized capabilities for the interactive visualization of very large (out-of-core) volume data, advanced image processing and analysis, efficient support for very large cell 3D models, interactive remote visualization, and 3D graphics output.

## Build robust foundations

Open Inventor is proven to be the safe choice for the long term and the most flexible tool to transfer technology evolutions and unique innovations to your solutions.

Open Inventor is carefully designed to introduce powerful new capabilities for your application in the most simple, transparent and consistent way, protecting your investment and anticipating needs that you may not even foresee. Last, the interoperability and extensibility ensure your complete freedom to best adapt the toolkit to your specific needs.

Open Inventor Medical Edition is available for Windows®, macOS®, Linux.  
Languages: C++, .NET, Java™.

## Rely on strong support and innovation

Dedicated to serving our customers, Thermo Fisher Scientific brings more than 30 years' experience in 3D visualization. Our support team pays particular attention to the constraints of professional developers, and works closely with R&D to coordinate with your development schedule.

Our Professional Services team is available to increase your efficiency through training, consultancy and custom development covering the whole life cycle of your project: from software and hardware requirements, prototyping, migration assistance, to system deployment and even cooperative R&D.

Find out more at [OpenInventor.com](http://OpenInventor.com)

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