Automated segmentation of atherosclerotic arteries in MR Images

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Glossary

Active Contour Models. Energy-minimizing curves that deform to fit image features.

Aorta. The largest artery in the human body, it originates from the left ventricle of the heart and brings oxygenated blood to all parts of the body in the systemic circulation.

ARIC. Atherosclerosis Risk in Comunities Trial.

Atherosclerosis. Disease of the arterial blood vessels which is characterized by build-up of fatty substances, cholesterol, cellular waste products, calcium and other substances in the inner lining of an artery. That build-up is called *atheromatous or atherosclerotic plaque*.

Bland-Altman plot. It shows the variability of the data as a function of the mean.

Carotid. Major artery of the head and neck. There are two carotid arteries one on the left and one on the right. Their accessibility and proximity to the surface makes them suitable for MRI.

Cluster. Grouping together of elements within a domain - usually spatial.

Conspicuity. State or quality of being clear or bright.

Contrast agents. Compounds used to improve the visibility of internal bodily structures in an image.

Coronary. The vessels that supply blood high in oxygen to the heart.

COV. Coefficient of Variation: measure of dispersion of a probability distribution. It is defined as the ratio of the standard deviation to the mean.

CT. Computed Tomography.

Data clustering. Process of dividing data elements into classes or clusters so that items in the same class are as similar as possible, and items in different classes are as dissimilar as possible.

Dynamic Programming. An operational research technique to facilitate the solution of sequential problems. It is a method of solving multi-stage problems in which the decisions at one stage become the conditions governing the succeeding stages.

ECST. European Carotid Surgery Trial.

Fat saturation. A specialized technique that selectively saturates fat protons prior to acquiring data as in standard sequences, so that they produce a negligible signal. The presaturation pulse is applied prior to each slice selection. This technique requires a very homogeneous magnetic field and very precise frequency calibration.

Fibrous cap. Layer of fibrous connective tissue that separates lumen from lipid core. It contains macrophages and smooth muscle cells.

FullWidth30%Max. Criterion used in thresholding techniques, by which all samples whose value is greater than 30% of the maximum value are considered to belong to the object and the rest to background.

Fuzzy clustering. In clustering, data elements can belong to more than one cluster, and be associated with each element is a set of membership levels. These indicate the strength of the association between that data element and a particular cluster. Fuzzy clustering is a process of assigning these membership levels, and then using them to assign data elements to one or more clusters.

Gradient. Rate of change with respect to distance of a variable quantity in the direction of maximum change.

Hough transform. Feature extraction technique used in digital image processing. The classical transform identifies lines in the image, but it has been extended to identifying positions of arbitrary shapes.

Image enhancement. Process of accentuating (sharpening) certain image features like edges, boundaries, or contrast for subsequent image analysis.

In vivo. Latin for *within the living. In vivo* is used to indicate the presence of a whole/living organism, in distinction to a partial or dead organism, or a computer model.

In vitro. Latin for *within glass. In vitro* is used to indicate experiments performed on organs, tissues, cells, cellular components, proteins or biomolecules outside a living organism.

Ionizing Radiation. Radiation of sufficiently high energy to knock electrons out of the orbits of atoms and molecules, often creating more ionizing radiation and adversely

affecting living tissues. Biologically significant radiation is an ionizing dose of radiation above 155 ev which may have carcinogenic, mutagenic, or other health effects in humans.

IVUS. Intravascular Ultrasonography.

Lumen. Cavity or channel along a blood vessel along which blood flows.

MESA. Multi-Ethnic Study of Atherosclerosis.

MRA. Magnetic Resonance Angiography.

MRI. Magnetic Resonance Imaging.

NASCET. North American Symptomatic Carotid Endarterectomy Trial.

Outward remodeling. Enlargement of the external layer of the vessel wall.

PDW. Proton density weighted MR image.

Segmentation. Partitioning of a digital image into two or more regions.

Snakes. Active Contour Models.

Statistically significance. A result is statistically significant if it is unlikely to have occurred by chance. In traditional frequentist statistical hypothesis testing, the significance level of a test is the maximum probability of accidentally rejecting a *true* null hypothesis. The significance of a result is also called its p-value; the smaller the p-value, the more significant the result is said to be.

Stenosis. Abnormal narrowing in a blood vessel or other tubular organ or structure.

Stroke. Sudden reduction of blood flow to a portion of the brain.

T1W. T1-weighted MR image.

Thrombus. Solid mass formed from the constituents of blood within the blood vessels or the heart.

TIA. Transient Ischemic Attack.

Tissue. Group of similar cells united to perform a specific function.

TOF. Time of Flight.

T-test. Any statistical hypothesis test in which the test statistic has a Student's t-distribution if the null hypothesis is true. The **paired** t-test is a version in which the two samples are paired, so that each member of one sample has a unique relationship with a particular member of the other sample.

Vulnerable plaque. Atheromatous plaque which is particularly prone to produce sudden major problems, such as a heart attack or stroke.