Iris Recognition – Update on Algorithms and Trials

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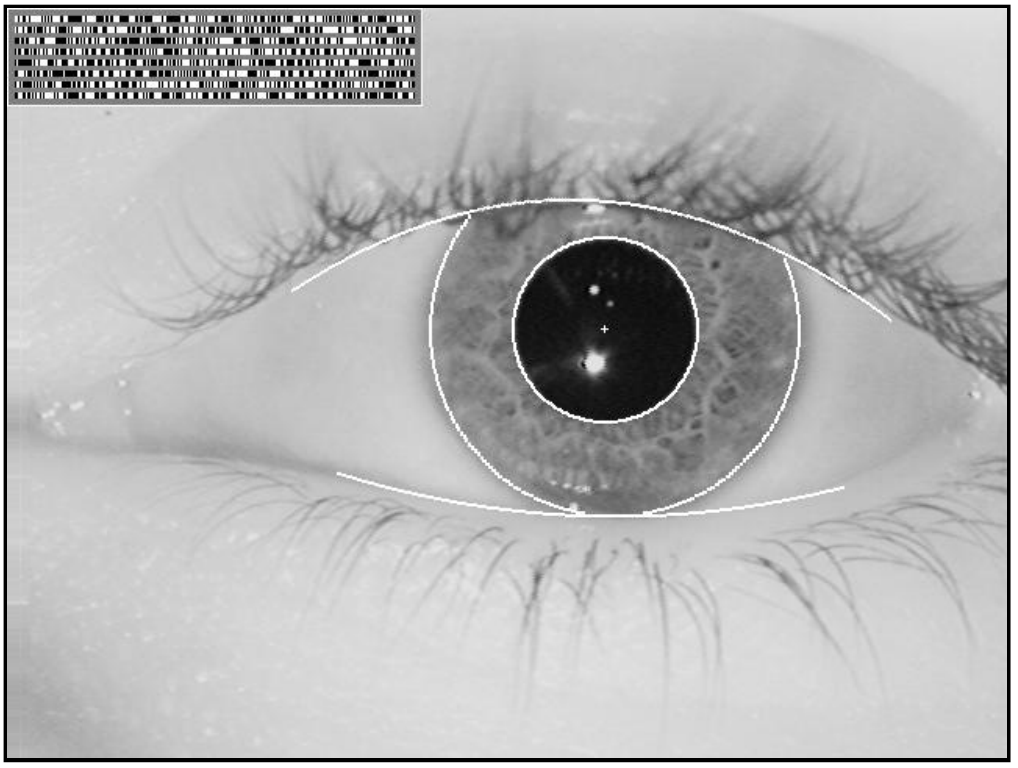
Iris recognition provides real-time, high confidence identification of persons by mathematical analysis of the complex patterns that are visible within the iris of an eye from some distance. Because the iris is a protected, internal, organ whose random texture is epigenetic and stable through life, it can serve as a kind of living passport. Recognition decisions are made with confidence levels high enough to support exhaustive searches through national databases.

Algorithms first described in 1993 for recognizing persons by their iris patterns have now been tested in several public field trials, producing no false matches in several million comparison tests. The recognition principle is the failure of a test of statistical independence on texture phase structure as encoded by multi-scale quadrature wavelets. This test of independence involving about 250 degrees-of-freedom is passed whenever different irises are compared, but it is failed when images of the same iris are compared. The discrimination entropy of iris phase sequences is about 3.2 bits/mm^2 over the iris. The resulting binomial combinatorics allows operation always in one-to-many "identification" mode, which is more demanding and useful than just one-to-one "verification" mode in which each person must always first assert an identity. The benefit is PIN-less, cardless, hands-free automatic identification, with database search speeds of about 100,000 persons per second.

This talk will review new developments in the core algorithms and will present data from 9.1 million recent IrisCode comparisons, together with the results of tests conducted by several independent testing organizations. The two summary histograms show the raw binomial process behind IrisCode bit comparisons, and the "same" vs "different" decision environments that arise. The algorithms described in this presentation have already been installed for passenger screening at Schiphol, Frankfurt, and Charlotte Airports, and will shortly be deployed at Heathrow Airport. But there remain several machine-vision related aspects of the process that are still in need of improvement, and these will be discussed.



Results from 9.1 million IrisCode Comparisons

The solid curve superimposed on the upper distribution is a binomial with $p = 0.5$ and $N = 249$ degrees-of-freedom, closely describing the data. The extreme-value distribution on the right in the lower graph results from repeated sampling of such a distribution to find the best match over many iris orientations. The left distribution in this "Decision Environment" portrayal shows comparisons between different images acquired from same irises.