Breve revisión de las ultimas publicaciones sobre face recognition

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Abstract

Con el proposito de establecer una rápida visión sobre el estado del arte en face recognition basada en una búsqueda simple en el servidor de Elsevier. Se trata de reunir referencias ordenadas en algunos ejes conceptuales que permitan situar las tendencias y resultados mas actuales.

1 Introducción

Puesto que no se trata de producir un artículo de "nivel internacional" el idioma es el castellano (spanish). Se agruparán las referencias bajo algunos epígrafes sin más aclaración o elaboración. El objetivo de esta revisión rápida es la identificación de ejes de investigación y de trabajo para la proposición de lineas futuras de trabajo, entre ellas la posible proposición de proyectos de tesis. Las referencias proceden de revistas de Elsevier.

El proceso de reconocimiento ha llegado a ungrado de madurez que permite proponer sistemas que realizan el reconocimiento dentro de sistemas de vigilancia on line [18].

Observamos que por si solo el tema en el que se producen más aportaciones en la literatura es del estudio de las técnicas de reducción de dimensiones.

2 Técnicas de reducción de dimensiones

El área de reconocimiento de caras ha servido de campo de pruebas para todo tipo de algoritmos de reducción de dimensiones, desde el éxito de la transformación en componentes principales (PCA). Una revisión reciente se encuentra en [68]. Algunas propuestas permiten aplicar directamente las transformaciones en 2D [9, 17]. En referencias recientes se han aplicado:

- discrete cosine transform (DCT) [13]
- nonsubsampled contourlet transform (NSCT) [11]
- curvelet [57]

- tecnicas basadas en experimentos sicologicos para la definición de un subespacio cognitivamente justificado [8].
- la transformada de Fourier-Mellin [10] para el reconocimiento basado en una sola imagen.
- los resultados de la compresión mediante distintas versiones de JPEG [15]
- Steerable Pyramid (S-P) wavelet transform [4]
- algoritmos geneticos y redes neuronales para la extracción de caracteristicas [19]
- tensor subspace analysis [23], tensor subspace regression [28]
- modular feature selection que permite fusión de imagenes multisensoriales [31]
- LBP (local binary patterns) para combinar apariencia y movimiento [32]
- Neighbourhood Preserving Discriminant Embedding (NPDE) que combina empotramiento de grafos y el criterio de Fisher [33]
- sub-pattern technique and whitened PCA [37]
- Radon and wavelet transforms [41], radon y DCT [42]
- usando las SVM para feature extraction [45]
- color y frecuencias espaciales locales y globales [51]
- Dominant singular value decomposition [54]
- discriminant locality preserving projections (based on maximum margin criterion) [53, 29]
- PCA [55, 30, 40, 63], PCA multilinear [83]
- 3D ridge images obtained from range data [56]
- decision-boundary-oriented feature selection [61]
- Subclass linear discriminant analysis [62]
- Sparsity preserving projections [65]
- tensor framework for image decomposition [67]
- bidirectional principal components [69]
- representaciones esféricas para el reconocimiento 3D [52]
- Hidden Markov Models para la captura de información dinámica [77]

- sub-pattern locality preserving projection [82]
- marginFace [80]
- Neighborhood preserving embedding (NPE) [85]
- Intrinsic Discriminant Analysis (IDA) [86]
- locality preserving projections (LPP) [87, 97, 94, 95]
- Dual optimal multiband features [89]
- Gabor: depth and intensity Gabor features para reconocimiento 3D [93] y Gabor fatures par imagenes "normales" [107], adaptive Gabor array [43], natural and gabor faces [75], una revisión reciente [71], local Gabor patterns [91], using Gamma & generalized Gaussian [102]
- interest operators [96]
- local ridge regression [98]
- bagging null space locality preserving discriminant analysis (bagNLPDA) [101]
- Semi-random subspace [110]
- sequential row-column ICA [23]
- multiple random projections [46]
- Orthogonal discriminant linear local tangent space [50]
- Median MSD [49]
- Multiple maximum scatter difference [64]
- graph-based semi-supervised dimensionality reduction (SSDR) [65]
- color spaces [100, 99]

3 Clasificadores innovadores

Se han probado para el reconocimiento de caras todo tipo de clasificadores. Siguen proponiendose innovaciones. EN [12] se propone una combinación de FuzzyARTMAP y discrete Particle Swarm Optimization. En [58] se propone logica borrosa de tipo 2 y redes neuronales modulares. Fuzzy discriminant analysis se propone en [60]

En [16] se propone un modelo discriminante incremental y métodos de fusión de pistas visuales. En [20] se proponen patrones incrementales para adaptarse a la variabilidad de las personas (pelo, ropa, etc). Un algoritmo de analisis

discriminante incremental se propone en [81]. En [39] se presenta una variante del analisis discriminante usando el kernel trick. En [103] se presenta una forma novedosa de complex discriminant analysis. Una modificación de Kernel Discriminant Analysis se propone en [108]

En [35] se propone un modelo generativo novedoso (Bayes network). Bayesian logistic discriminant model [48]. En [66] se propone un ED boost para la clasificación en el dominio de la imagen comprimida con JPEG. En [70] se aplica probabilistic learning para reconocimiento invariante a cambio de pose. En [84] se propone una distancia específica "Kernel Grassmannian distances " para su aplicación en análisis discriminante.

Las RBF se proponen en [5] para el reconocimiento en tiempo real de la boca y la cara. En [36] se proponen adiciones de kernels lineales locales.

En [109] se propone una nueva clase de kernels para las SVM basada en la distancia del convex hull.

4 La estimación de la pose y la reconstruccion 3D.

La estimación de la pose consiste en estimar la dirección de la cabeza (mirada) en el marco espacial de la cámara. En [3] se reconstruye a partir de video. En [106] se discuten los algoritmos robustos frente a pose que se han propuesto.

El reconocimiento 3D es también un tema candente [73, 104]. En [34] se propone un sistema innovador de reconstruccion facial 3D basado en estéreo fotométrico. En [59] se proporciona una revisión del estado del arte en reconomiento facial 3D. En [74] se realiza el reconocimiento sobre modelos 3D ajustados sobre los datos mediante analisis discriminante generalizado.

5 El problema de la iluminación

La iluminación es un determinante del aspecto de la cara, es por tanto un problem fundamental encontrar formas de eliminar el efecto de la iluminación, ya sea creando algoritmos robustos o filtrando la iluminación. En [1] se propone un modelo de iluminación que permite eliminar muchos de los efectos en la imagen. En [3] se crea una variedad para la normalización de las imagenes a partir de video. En [2] se establece una competición entre los resultados de varios filtros para construir un clasificador invariante a iluminación bajo fuertes cambios de pose. En [11] se propone una método de extracción de carácterísticas robusto frente a iluminación. En [21] se trata de resolver mediante fusión de clasificadores. En [26] se hace una revision y comparación de métodos robustos a iluminación, con propuestas de combinación. En [38] la correción y robusted se basa en la simetria de la imagen facial. En [44] se utiliza contraste local y extracción adaptativa de caracteristicas. En [79] se estima la dirección de la luz para compensarla. En [105] una representacion multiescala mediante wavelets se propone para obtener reconocimiento robusto frente a iluminación.

6 EL problema de la validación

Existen gran cantidad de recursos para la validación de las aproximaciones a la construccion de algoritmos, pero pocos trabajos que intenten explorar el efecto del diseño experimental. En [6] se estudia la relación desde un punto de vista estadístico: como influye el sexo, edad, etc. en los rendimientos de los algoritmos. En [27] se estudia el efecto que tiene la pérdida debida a compresión en el reconocimiento. En [22] se estudia la robusted de algoritmos de reconcimiento contra ataques consistentes en la presentación intencionada de imagenes que inducen error de clasificación.

7 reconocimiento miscelaneo

En algunos trabajos el objetivo no es la identificación de la persona sino el reconocimiento de carácterísticas abstractas, como la madurez personal [7]. Muchos de los trabajos se dirigen al reconocimiento en secuencias de video [32]. En otros casos [72] se trata de reconocimiento robusto frente disfraz. Tambien existen intentos de reconocimiento robusto frente a cambios de expresión [24, 76]. La fusión de reconocimiento de expresiones e identificación se estudia en [78], y en [88] usando una mezcla de expertos locales. En [92] se estudia la aplicación de la textura y forma al reconocimiento de caras.

La normalización del color [100] también añade mejoras de rendimiento. En [111] se estudia el efecto del post-proceso en el funcionamiento de los clasificadores. En [14] se estudia el reconocimiento de la edad a partir de imagenes de caras. En [25] se estudia la fusión de "gait" y reconocimiento facial. En [47] se ataca el problema de la detección y localización de los ojos.

El problema del reconocimiento de bosquejos en fotos se estudia en [90].

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