

Automated classification of ELODIE stellar spectral library using probabilistic artificial neural networks

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Abstract. A Probabilistic Neural Network model has been used for automated classification of ELODIE stellar spectral library consisting of about 2000 spectra into 158 known spectro-luminosity classes. The full spectra with 561 flux bins and a PCA reduced set of 57, 26 and 16 components have been used for the training and test sessions. The results show a spectral type classification accuracy of 3.2 sub-spectral type and luminosity class accuracy of 2.7 for the full spectra and an accuracy of 3.1 and 2.6 respectively with the PCA set. This technique will be useful for future upcoming large databases and their rapid classification.

Keywords : Probabilistic Neural Network (PNN) – stellar spectra – Principal Component Analysis

1. Introduction

In recent years, Artificial Neural Networks (ANNs) have become very useful tool for classification type applications (in particular the stellar spectral classification) in astronomy. Some of the pioneering efforts of application of ANNs to stellar spectral classifications are: Gulati et al. (1994a, 1994b), Gulati et al. (1995), Von Hippel et al. (1994), Weaver et al. (1995), Singh et al. (1998, 2003), Gupta et al. (2004), and several other groups. All these applications have used ANNs in various forms based on supervised methods where, the computer is trained with certain known classes of spectra and then at the

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post-training stage, the test set of spectra are input to the programme for a quick classification. The use of Principal Component Analysis (PCA) greatly reduces the complexity of the training matrix to a manageable dimension. Most of the previous attempts for automatic classification of stellar spectra were done using backpropagation algorithm but in this work probabilistic neural network by Specht (1990) is presented, which offers some advantages over the backpropagation technique like: fast training process, no local minima issues, guaranteed to converge to an optimal classifier as the size of representative training set increases, though it suffers from some disadvantages like large memory and more representative training set requirements.

Section 2 discusses the input data format; section 3 outlines the PNN technique; section 4 discusses the PCA method; section 5 gives the performance and results and finally the section 6 gives the conclusions of this study.

2. Input data

Jacoby et al. (1984) (hereafter referred as JHC library) was used as sample spectra for training of the neural network. This library covers the wavelength range 3510-7427 Å for various O to M type stars which contain 161 spectra of individual stars and 158 spectra were selected from this library as a set of learning patterns to neural networks. The ELODIE.3 stellar library, Prugniel & Soubiran (2001, 2004) was used as a set of testing patterns to neural network for classification. This library covers the wavelength range of 4000 to 6800 Å and contains 1962 spectra of which 1959 spectra are selected for the classification. The library is given at two resolutions high and medium of which the medium resolution is selected. The spectral resolution of JHC is 4.5 Å with one flux value per 1.4 Å and the ELODIE has a resolution of 0.55 Å with each flux value at 0.2 Å. Both these libraries were brought to a common platform of spectral resolution of 4.5 Å and sampling fluxes every 5 Å steps (a total of 561 bins) and a wavelength range of 4000–6800 Å. This was achieved by using appropriate convolution and spline fitting routines. Both the libraries were also normalized to unity to take care of difference in flux calibration process of two libraries.

3. Probabilistic neural networks

The Probabilistic Neural Network was introduced by Specht (1990). This technique can be used for the classification problem and estimation of class membership (Specht 1994). This network is a supervised neural network and its development relies on Parzen windows classifier and is the direct continuation of the work of Bayes classifiers (Specht 1990; Parzen 1962). The Parzen windows method is a non-parametric procedure that synthesizes an estimation of a probability density function (pdf) by superposition of a number of windows. The PNN learns to approximate the pdf of the training samples.

In the first step the distance between input vector and the training input vectors will be evaluated and then a vector will be produced from which the similarity and closeness of the input to training input will be known. In the next stage the summation of these contributions for each class of inputs will take place in order to produce a vector of probabilities as its net output, and then the maximum of these probabilities will be selected and will be available at the output.

The architecture of a PNN is illustrated in Fig. 1 with four layers: the input layer, the pattern layer, the summation layer and the output layer. An input vector $X = (x_1, x_2, \dots, x_n) \in R^n$, is given to the input neurons and then passed to the pattern layer, the neurons of which grouped and each group will be dedicated to one class (or here to one spectra of the training set). The output of the i^{th} pattern neuron of K^{th} group in the pattern layer will be in the form,

$$P_{k,i}(X) = \frac{1}{(2\pi\sigma^2)^{n/2}} \exp\left(-\frac{\|X - X_{k,i}\|^2}{2\sigma^2}\right), \quad (1)$$

where $X_{K,i} \in R^n$ is centre of the kernel, σ known as the spread or smoothing parameter. Then the summation layer of the network, which computes the approximation of the conditional class probability function given as:

$$S_k(X) = \sum_{i=1}^{N_k} \omega_{k,i} P_{k,i}(X), \quad k \in \{1, \dots, K\}, \quad (2)$$

where N_k is the number of neurons of class k, which in our case N_k will be 561. ω_{ki} are positive coefficients satisfying $\sum_{i=1}^{N_k} \omega_{ki} = 1$. Then finally at the output layer we have:

$$C(X) = \arg \max_{1 \leq k \leq K} (S_k). \quad (3)$$

As seen in Fig. 1, the pattern layer is fully connected to the input layer, with one neuron for each pattern in the training set. The weight values of the neurons in this layer are set equal to the different training patterns. The summation is carried out by the summation layer neurons. The weights on the connections to the summation layer are fixed at unity so that the summation layer simply adds the outputs from the pattern layer neurons. The output layer neuron produces a binary output value corresponding to the largest pdf, this indicates the best classification for the pattern.

4. Principal Component Analysis

Principal Component Analysis (PCA) is widely used in signal processing, statistics and neural computing. The main idea in using PCA is to extract the components which gives maximum amount of variance. A 1959×561 matrix, which is input data size with 1959 rows as the number of spectra to be classified and 561 is the size of each spectra. With

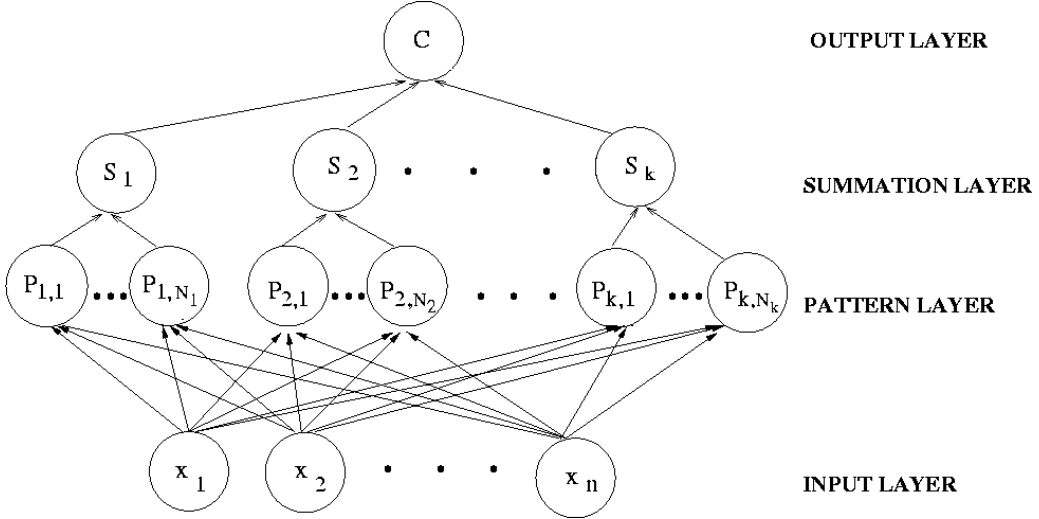


Figure 1. Schematic of a typical Probabilistic Neural Network.

the help of PCA first tried to reduce the size of input vectors to simplify the network. The PCA transforms input vector with highly correlated dimension of 561 variables by orthogonal transformation to lower the number of uncorrelated variables which are called principal components. The resulting principal components come in an ordered manner such that the first principal component has the largest variation and it will be in reducing order to the next and subsequent principal components, and it eliminates the variables with lowest variation in the whole spectra.

This technique is applied to both the training and test data sets and the best performance obtained with 26 principal components as shown in Table 1.

Table 1. Network performance for PNN with PCA and Full Set.

Number	Principal Component	r^1	s^2
1	57	0.924177	452.3178
2	26	0.92483	448.4866
3	16	0.92440	450.2248
4	Full spectra (No PCA)	0.92384	454.6563

¹correlation coefficient, ²standard deviation

5. Performance and result

5.1 Spectral class coding

The performance of the ANN is judged by a quantitative correlation analysis. The spectro-luminosity classes which are usually in an alpha-numeric fashion, had to be converted into a numeric code number (Gulati et al. 1994a) which is unique to each spectro-luminosity class and is given as follows:

$$CodeNumber = 1000.0 \times A1 + 100.0 \times A2 + (1.5 + 2 \times A3) \quad (4)$$

where A1 represents the spectral type of the star (ranging from O to M which is numbered as 1 to 7); A2 is the sub-spectral type of the star (with codes ranging from 0.0 to 9.5); and A3 represents the luminosity class of the stars (ranging from I to V classes which is coded into numbers ranging from 0 to 4). For example consider alpha-numeric spectro-luminosity class F3 II which will be coded as 4303.5 and K9.5V will be coded as 6959.5.

Table 2. List of spectra appearing in Fig. 4.

Panel	Jacoby spectra	Jacoby spectral class	ELODIE spectra	ELODIE spectral class
a	HD 10032	4009.5	HD 338529	2509.5
b	SAO 87716	3301.5	HD 190864	1705.5
c	SAO 87716	3301.5	HD 000108	1609.5
d	HD 23733	3909.5	HD 172488	2059.5
e	TR A14	5409.5	HD 017378	3501.5
f	HD 26514	5605.5	HD 216131	7205.5
g	HD 12842	4301.5	HD 049330	2009.5
h	SAO 21536	4401.5	HD 172488	2059.5
i	BD 58 ° 0204	4201.5	HD 225160	1809.5
j	BD 00 ° 3227	4503.5	HD 172488	2059.5
k	SAO 21536	4401.5	HD 018409	1901.5
l	SAO 21536	4401.5	HD 192639	1809.5
m	HD 56030	4605.5	HD 016429	1955.5
n	SAO 21536	4401.5	HD 015558	1509.5
o	SAO 21536	4401.5	HD 015629	1509.5
p	HD 107399	4909.5	HD 184499	1009.5

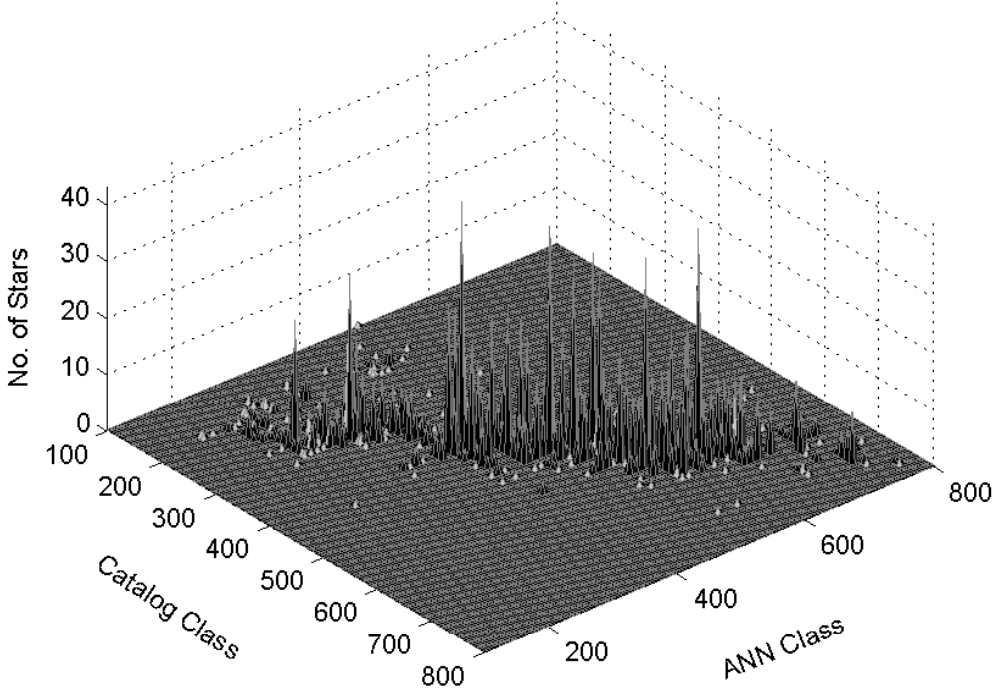


Figure 2. ELODIE library classification using PNN with PCA before rejection.

5.2 Performance

The performance of the classification is evaluated by correlation analysis. The list of 1959 ELODIE.3 spectra classified by different networks with different number of principal components was correlated with respect to the catalog classification given in ELODIE at the website:

http://www-obs.univ-lyon1.fr/~prugniel/soubiran/v3/table_meas.dat

Table 1 shows the network performance estimated from the linear correlation coefficient, r , and the standard deviation, s , of the network and catalog classification. The best performance is for the network with 26 Principal Components (PCs) with lowest standard deviation and largest correlation coefficient.

5.3 Result

The Neural Network with PNN technique is used to obtain the results given in Table 1. The result of the classification is in the form, such that, for each spectra of ELODIE

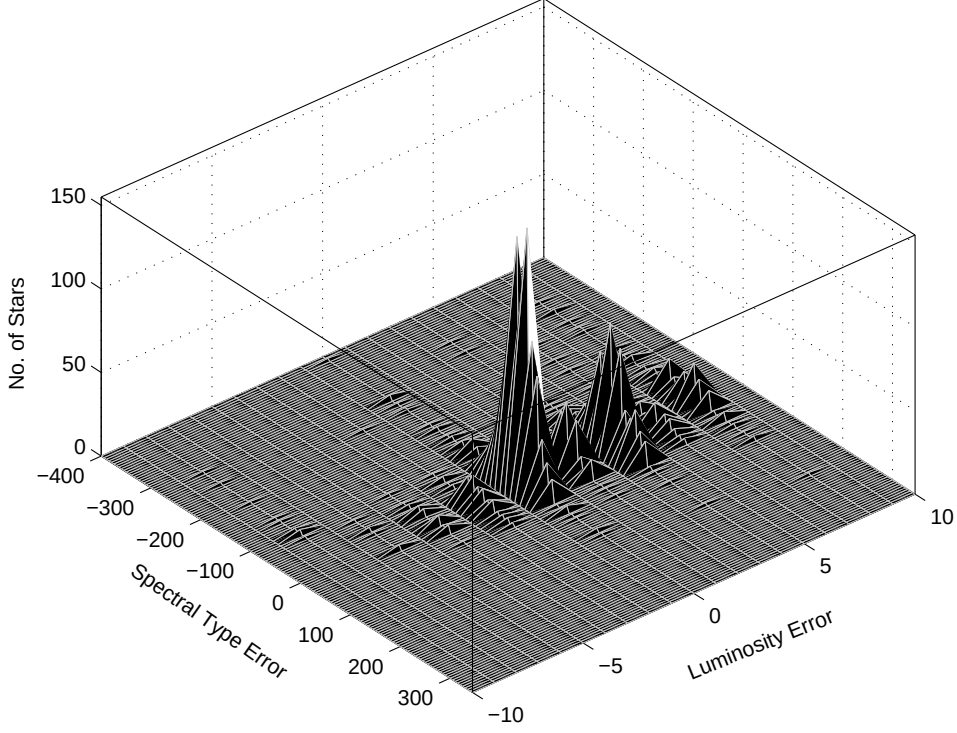


Figure 3. ELODIE library classification using PNN with PCA before rejection.

library (test set for ANN), there is a corresponding spectra from JHC library (training set for ANN) which is its respective spectro-luminosity class. This result is given in Table 7 (see Appendix) where the name of the star, their spectral and luminosity classes given by ANN and Catalog (the website given at Section 5.2) are presented. The result of the classification of PNN with 26 PCs is presented in a 3D scatter plot format in Fig. 2. This figure also shows the number of spectra available at each spectral type and luminosity class.

Fig. 3 is another 3D picture of classification errors in spectral type and luminosity class shown on the horizontal axis. Some of the misclassified spectra with large classification errors are presented in Fig. 4 where, panel 16 shows 16 misclassifications according to the ANN result. The spectra in dotted lines represent those from the learning library (JHC) and the spectra in solid lines are the corresponding ones from the test library (ELODIE). Table 2 describes the details of Fig. 4 with the names of the spectra plotted in each panel and their coded spectral class. These plots contribute to the largest classification errors (i.e. high difference between ELODIE class in Catalog and class obtained by ANN). But the plots do not support this and show good match of these pairs of spectra. So, the classes obtained by ANN could be the correct class of those spectra.

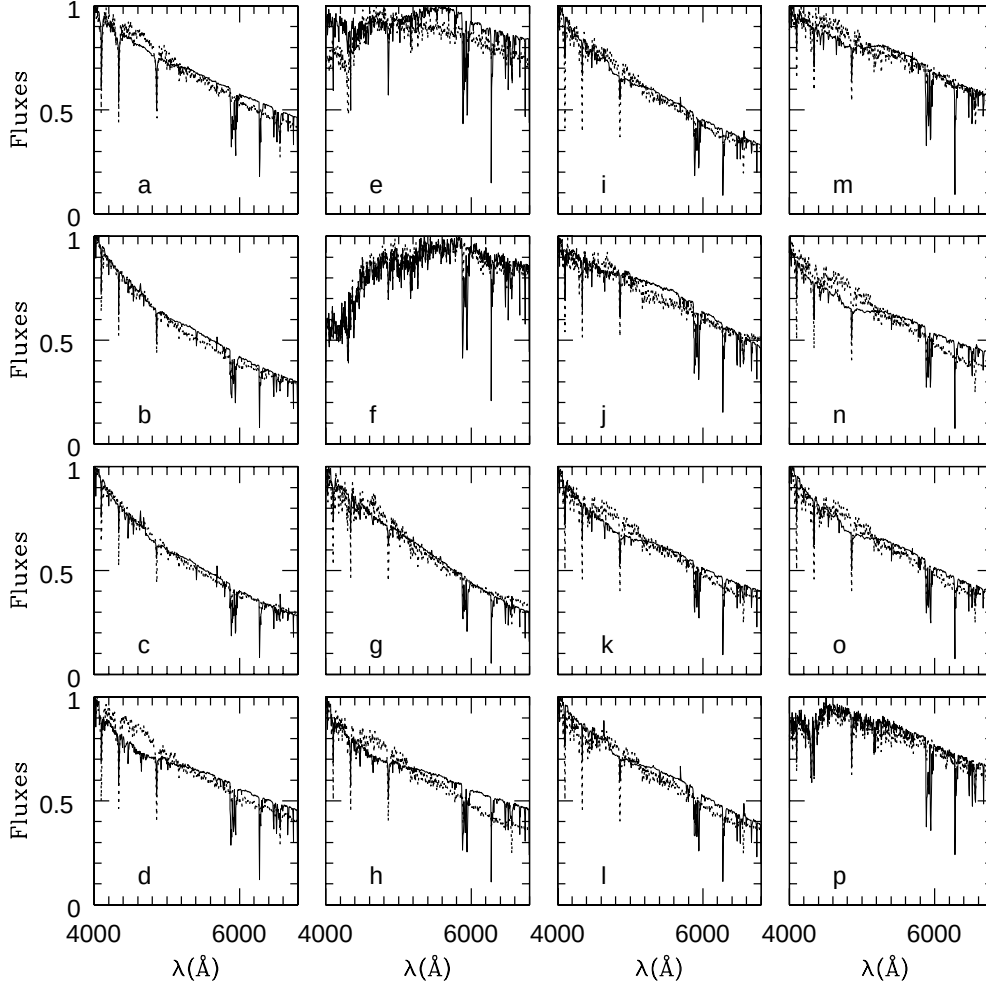


Figure 4. Plots of Jacoby library vs. ELODIE library listed in Table 2.

The result of ANN produced in two schemes:

(1) With PCA:

In this scheme first, PCA reduction technique is applied to reduce the size of spectra from 561 to 26 PCs and then PNN is used for automatic classification. As seen from the scatter plot in Fig. 2, there are some spectra which are outliers and contribute to the large errors in the classification result; these spectra are rejected and their list is given in Table 3. This table gives the name of rejected spectra, their class given by catalog and that obtained from ANN and the corresponding error.

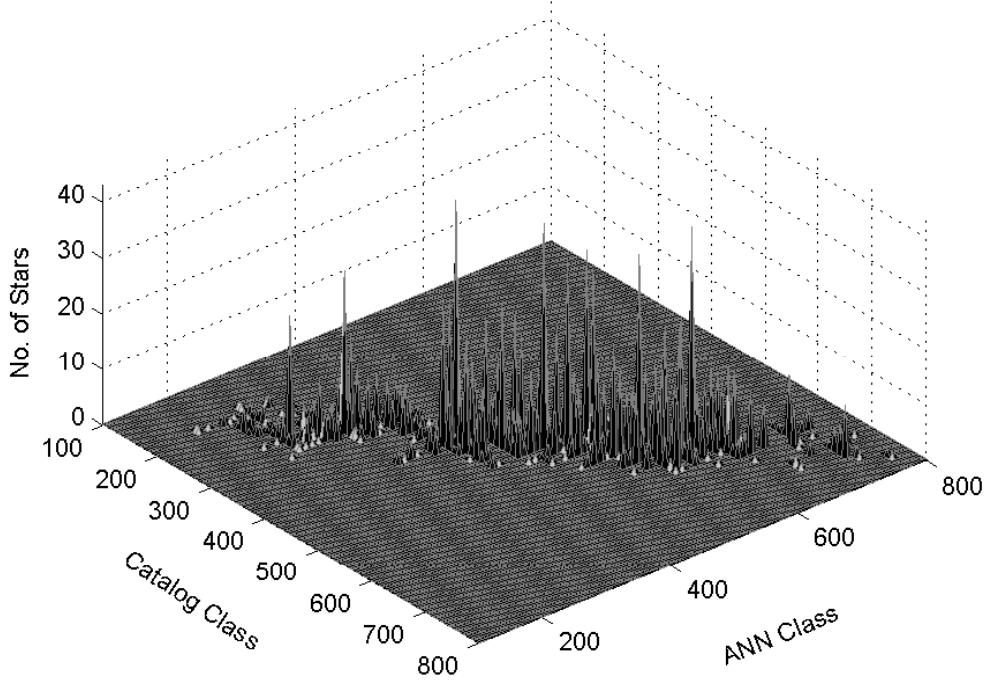


Figure 5. 3-D Scatter diagram of ELODIE library classification using PNN with PCA after rejection

The accuracy of the classification is evaluated separately for the Spectral Type (ST) and Luminosity Class (LC) before and after rejection of the spectra listed in Table 3 from the result of classification of PNN with PCA, and the summary of this is given in Table 4.

After rejecting the spectra listed in Table 3, the 3D scatter plot is shown in Fig. 5.

(2) Without PCA:

In this scheme the PNN is applied to whole spectra of size 561 flux bins. The list of spectra rejected in this scheme is same as in Table 3, in addition with the spectra listed in Table 5.

The accuracy of the classification for ST and LC before and after rejection is given in the Table 6.

Table 3. List of spectra rejected in PNN with PCA.

Spectra Name	Catalog Class	ANN Class	Error
HD002796	4109.5	5309.5	-1200
HD014374	5009.5	6009.5	-1000
HD014626	6009.5	7009.5	-1000
HD017925	6109.5	5001.5	1108
HD019445	3409.5	4509.5	-1100
HD034078	1959.5	3301.5	-1342
HD034078	1959.5	3301.5	-1342
HD038237	3309.5	4601.5	-1292
HD043823	4209.5	5409.5	-1200
HD045674	4009.5	5409.5	-1400
HD048279	1809.5	2805.5	-996
HD099649	5509.5	4009.5	1500
HD099649	5509.5	4009.5	1500
HD154543	6209.5	7305.5	-1096
HD163346	3309.5	4503.5	-1194
HD184499	1009.5	4909.5	-3900
HD205811	4209.5	3109.5	1100
HD216131	7205.5	5301.5	1904
HD218502	4309.5	2101.5	2208
HD338529	2509.5	4009.5	-1500
HD039681	2909.5	3909.5	-1000
BD+362165	5009.5	4007.5	1002
HD000108	1609.5	2701.5	-1092
HD000108	1609.5	3301.5	-1692
HD001835	5309.5	7303.5	-1994
HD008992	4601.5	5909.5	-1308
HD013267	2501.5	4201.5	-1700
HD013268	1809.5	2801.5	-992
HD014947	1609.5	3909.5	-2300
HD015558	1509.5	4401.5	-2892
HD015570	1409.5	4605.5	-3196
HD015629	1509.5	4401.5	-2892
HD016429	1955.5	4605.5	-2650
HD016429	1955.5	4605.5	-2650
HD016429	1955.5	4605.5	-2650
HD017145	2801.5	5309.5	-2508
HD017378	3501.5	5409.5	-1908
HD018409	1901.5	4401.5	-2500
HD024496	5009.5	6009.5	-1000
HD034078	1959.5	3301.5	-1342
HD034078	1959.5	3301.5	-1342
HD049330	2009.5	4301.5	-2292
HD053003	5001.5	6009.5	-1008
HD054908	3009.5	4009.5	-1000
HD057838	6209.5	5101.5	1108
HD089010	5207.5	7509.5	-2302

Table 3. Continued.

Spectra Name	Catalog Class	ANN Class	Error
HD096094	5009.5	3805.5	1204
HD110184	5509.5	6705.5	-1196
HD157857	1709.5	2701.5	-992
HD159307	4809.5	3809.5	1000
HD161370	3009.5	4009.5	-1000
HD166734	1809.5	5001.5	-3192
HD170739	2809.5	4009.5	-1200
HD172171	6105.5	7505.5	-1400
HD172488	2059.5	3909.5	-1850
HD172488	2059.5	4401.5	-2342
HD172488	2059.5	4503.5	-2444
HD174512	2809.5	4503.5	-1694
HD178359	4507.5	5803.5	-1296
HD182736	5009.5	6009.5	-1000
HD182736	5009.5	6009.5	-1000
HD186980	1759.5	2801.5	-1042
HD190864	1705.5	3301.5	-1596
HD192639	1809.5	4401.5	-2592
HD195592	1951.5	4809.5	-2858
HD199579	1609.5	2701.5	-1092
HD202124	1951.5	4301.5	-2350
HD206165	2201.5	3301.5	-1100
HD210839	1609.5	3301.5	-1692
HD213470	3301.5	4309.5	-1008
HD216131	7205.5	5605.5	1600
HD216572	3009.5	4709.5	-1700
HD217086	1709.5	4605.5	-2896
HD223385	3301.5	4709.5	-1408
HD225160	1809.5	3301.5	-1492
HD225160	1809.5	4201.5	-2392

Table 4. Accuracy of classification for PNN with PCA.

Accuracy before rejection	Accuracy after rejection
4.4 ST	3.1 ST
2.7 LC	2.6 LC

6. Conclusion

The classification of ELODIE on the basis of JHC, then comparing the result of ANN classification with catalog classes and scanning for the spectra contributing to higher

Table 5. List of rejected spectra for PNN without PCA.

Spectra name	Catalog class	ANN class	Error
HD016429	1955.5	4309.5	-2354
HD110184	5509.5	6603.5	-1094
HD166734	1809.5	5101.5	-3292
HD172488	2059.5	4307.5	-2248
HD199579	1609.5	3001.5	-1392
HD216131	7205.5	5705.5	1500

Table 6. Accuracy of classification for PNN without PCA.

Accuracy before rejection	Accuracy after rejection
4.5 ST	3.2 ST
2.8 LC	2.7 LC

error and plotting them, shows that though the spectral class given in catalog is different than that of given by ANN for these plots, but Fig. 4 show that they are of same spectro-luminosity class and it supports ANN classification result. So by considering these corrections for misclassification the standard deviation values given in Table 1 will be much lower and also the classification accuracy will improve. The whole set of ELODIE library is classified with JHC library as reference to the spectral type accuracy of 3.2 sub-spectral type and luminosity class accuracy of 2.7 for full spectra and spectral type accuracy of 3.1 sub-spectral types and luminosity class accuracy of 2.6 for PNN with 26 PCs.

The classification of all of the ELODIE test spectra was done in few seconds, so classification of very large spectral libraries can be done in considerably short time using this technique in future.

Acknowledgment

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Appendix

Table 7. ELODIE Classification using PNN

Star Name	ANN Class	Catalog Class*
HD000245	F9V	G2V
HD000358	B8III	B8IVmnp..
HD000400	F7V	F8IV
HD000693	F4V	F5V
HD001227	G7III	G8II-III
HD001835	G5IV	G3V
HD002665	G4V	G5III
HD002665	G4V	G5III
HD002796	G3V	Fw
HD003268	F7V	F7V
HD003546	G6III	G5III
HD003567	F6III	F5V
HD003628	G2V	G2V
HD003712	K0I	K0II-III
HD003712	K0I	K0II-III
HD004306	G4V	G0
HD004306	G4V	G0
HD004307	G3V	G2V
HD004395	G4V	G5
HD004614	F9V	G0V

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD005234	K2III	K2III
HD005395	G7III	G8III-IV
HD005448	A6V	A5V
HD005516	G8III	G8III-IV
HD005600	F3V	F8
HD005916	G6III	G8III-IV
HD005916	G6III	G8III-IV
HD006582	G4V	G5Vp
HD006582	G4V	G5Vp
HD006755	G4V	F8V
HD006833	K0I	G8III
HD006920	G0III	F8V
HD008724	G6III	G5
HD009562	F8III	G2IV
HD009562	F5II	G2IV
HD009927	K3III	K3III
HD009927	K3III	K3III
HD010145	G7V	G5V
HD010307	F9V	G2V
HD010380	K3III	K3III
HD010476	G6III	K1V
HD010700	K0V	G8V
HD010780	G6III	K0V
HD012235	F9V	G2IV
HD012235	F9V	G2IV
HD012235	G2IV	G2IV
HD013530	G7III	G8III:var
HD013612	F7V	F8V
HD013612	F7V	F8V
HD013783	G3V	G8V
HD013974	G2V	G0V
HD013974	G3V	G0V
HD014128	F0IV	F0
HD014128	F5I	F0
HD014214	G0III	G0.5IV
HD014214	G0III	G0.5IV
HD014214	F8I	G0.5IV
HD014214	G0III	G0.5IV
HD014374	K0V	G0
HD014625	G8II	G8III
HD014626	M0V	K0
HD014690	F0III	F0Vn
HD014690	F4I	F0Vn
HD014690	A8III	F0Vn
HD014690	F0III	F0Vn
HD015596	G6III	G5III-IV
HD015596	G6III	G5III-IV
HD015596	G6III	G5III-IV

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD016458	K1I	G8p
HD016765	F6V	F7IV
HD016765	F6V	F7IV
HD016765	F6V	F7IV
HD017382	G9III	K1V
HD017925	G0I	K1V
HD018768	G3V	F8
HD018995	A9V	F0
HD019019	F7V	F8
HD019304	F0IV	F0
HD019308	G2V	G0
HD019373	F9V	G0V
HD019445	F5V	A4p
HD019476	K0III	K0III
HD019648	F5II	F0
HD019994	F7V	F8V
HD019994	F7V	F8V
HD020039	G4V	F8
HD020468	K4III	K2II
HD020512	K0V	G5
HD020512	K0V	G5
HD022049	K0III	K2V
HD022211	G2V	G0
HD022484	F7V	F9V
HD022484	F7V	F9V
HD022556	F9V	F8
HD022879	F7V	F9V
HD023183	K0III	G8III
HD023439	G6III	K1V
HD023862	B5III	B7p
HD023862	B4III	B7p
HD023862	B5III	B7p
HD023862	B5III	B7p
HD023862	B5III	B7p
HD023862	B4III	B7p
HD023862	B4III	B7p
HD024040	G2V	G0
HD024053	G7V	G0
HD024534	B1I	O9.5pe
HD024534	B1I	O9.5pe
HD024552	G2V	G0
HD025329	G9III	K1V
HD025457	F6V	F5V
HD025457	F6V	F5V
HD025621	F6V	F6IV
HD025621	F6V	F6IV
HD025621	F6V	F6IV
HD026297	G8II	G5/G6IVw

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD026462	F3IV	F4V
HD026462	F3IV	F4V
HD026630	G1I	G0Ib
HD027022	K0V	G5III
HD027340	A6V	A2
HD027348	G8III	G8III
HD028005	G5IV	G0
HD012235	F9V	G2IV
HD028099	G7V	G8V
HD028343	M0V	K7V
HD028946	K0V	K0
HD029139	K5I	K5III
HD029310	G2IV	G1V
HD029391	A9V	F0V
HD029391	A9V	F0V
HD029574	K3III	G8/K0IIIw
HD029697	K4V	K3V
HD030495	G2IV	G3V
HD030562	G2IV	F8V
HD030562	G2IV	F8V
HD030834	K4III	K3III
HD031293	B4V	A0pe
HD032147	K4V	K3V
HD033256	F3IV	F2V
HD033256	F3IV	F2V
HD033313	F3V	F8
HD033608	F3V	F5V
HD033608	F3V	F5V
HD033751	K0III	K0
HD033751	K0III	K0
HD034078	A3I	O9.5Vvar
HD034078	A3I	O9.5Vvar
HD034411	G2V	G0V
HD035369	G7III	G8III
HD035620	K4III	K4IIIp
HD294165	G3V	F8
HD036395	M3III	M1V
HD037160	G7III	G8III-IV
HD037202	B2.5III	B4IIIp
HD037202	B2.5III	B4IIIp
HD037742	B3I	O9Iab:
HD037788	A8III	F0IV
HD037828	G8II	K0
HD037958	B8III	B8
HD038145	F0V	F0
HD038237	F6I	A3
HD038270	A1V	B9...
HD038270	A1V	B9...

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD038309	F4I	F0III:n
HD038529	G6III	G4V
HD038674	K5I	K2
HD038675	M1I	K5
HD038769	F3IV	F0
HD038858	G2V	G4V
HD039003	K2III	K0III
HD039118	G9III	G8III+...
HD039400	K3III	K2IIvar
HD039400	K3III	K2IIvar
HD039587	G2V	G0V
HD039833	G2V	G0III
HD039853	K5I	K3...
HD040573	B9III	A0
HD040259	F0V	F0V
HD040335	A6III	A0
HD040372	A6III	A5me...
HD040446	A1V	A1Vs
HD040460	K0III	K1III
HD040460	K0III	K1III
HD040512	F3IV	F5IV
HD040573	A1V	A0
HD040616	G3V	G0
HD040616	G3V	G0
HD041079	K3III	K2
HD041142	A8V	F0
HD041143	G8II	K0
HD041307	G8II	K0
HD041380	K0III	G4III
HD041433	G3I	K0
HD041597	G8II	G8III
HD041661	F3V	F2
HD041712	F5II	F2
HD041770	F3IV	F2
HD042217	M1I	K5
HD042250	K0V	G5
HD042548	F0IV	F0
HD042618	G3V	G4V
HD043318	F3V	F6V
HD043318	F3V	F6V
HD043338	A9V	F0
HD043358	F5II	F5IV:
HD043587	F9V	G0.5Vb
HD043587	F9V	G0.5Vb
HD043587	F9V	G0.5Vb
HD043587	G2V	G0.5Vb
HD043823	G4V	F2
HD043856	F6V	F6V

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD044007	G9III	G5IV:w...
HD044195	A8III	F0
HD044285	K3III	K2
HD044418	G7III	K0
HD044638	K2III	K0
HD044770	F0IV	F5V
HD044771	G8II	K0
HD044966	F6V	F5
HD044985	G0III	F8
HD044990	K0I	K1Iab...
HD045067	F7V	F8V
HD045067	F7V	F8V
HD045212	K5I	K2
HD045282	G4V	G0
HD045282	G3V	G0
HD045431	F4I	F0
HD045600	F3V	F5
HD045674	G4V	F0
HD045759	F6V	F8
HD045829	K4III	K0Iab
HD045910	B2III	B2:IIpshe
HD045910	B2III	B2:IIpshe
HD046090	G6V	G0
HD046304	F0III	F0Vnn+...
HD046304	A9V	F0Vnn+...
HD046304	A9V	F0Vnn+...
HD046304	A9V	F0Vnn+...
HD046304	F6I	F0Vnn+...
HD046304	A9V	F0Vnn+...
HD046304	F0III	F0Vnn+...
HD046304	F0III	F0Vnn+...
HD046304	A9V	F0Vnn+...
HD046304	A9V	F0Vnn+...
HD046304	F6I	F0Vnn+...
HD046304	F6I	F0Vnn+...
HD046304	F6I	F0Vnn+...
HD046304	F6I	F0Vnn+...
HD046454	K4III	?K0
HD046480	G6III	G8IV-V
HD046480	G6III	G8IV-V
HD046558	A9V	F0
HD046784	M3III	M0III
HD047072	A8V	F0II
HD047309	G3V	G0
HD048144	K7III	K5
HD048279	B5I	O8
HD048279	B8III	O8
HD048433	K3III	K1III

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD048568	F3IV	F2
HD048596	K3III	K0
HD049063	K0I	G5
HD049368	M3III	S...
HD049434	A8III	F1V
HD049434	F0III	F1V
HD049434	A8III	F1V
HD049434	F0III	F1V
HD049434	A8III	F1V
HD049434	A8III	F1V
HD049434	A8III	F1V
HD049434	A8III	F1V
HD049434	A6III	F1V
HD049434	A8III	F1V
HD049434	A8III	F1V
HD049434	A6III	F1V
HD049434	A6III	F1V
HD049434	A6III	F1V
HD049932	F5II	F5
HD049933	F0V	F2V
HD050039	F3IV	F5
HD050281	K4V	K3V
HD050522	G1I	G5III-IV
HD050554	F9V	F8
HD051530	F7V	F8Vbwvar
HD055057	F0V	F2V
HD055057	F0V	F2V
HD057651	M4III	K5
HD057651	M4III	K5
HD057749	F0V	F3IV
HD057749	F0V	F3IV
HD058946	A9V	F0V...
HD059688	G2V	G0
HD060111	A9V	F2V
HD060503	K2I	K0
HD060803	F9V	G0V
HD060803	F9V	G0V
HD061366	G8II	G5
HD061421	A9V	F5IV-V
HD061421	A9V	F5IV-V
HD061421	F5II	F5IV-V
HD061421	F5II	F5IV-V
HD061421	F5II	F5IV-V
HD061421	F0IV	F5IV-V
HD061421	F5II	F5IV-V
HD062161	F5II	F5
HD062323	F7V	F8
HD062437	A2I	F0III

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD062509	G8III	K0IIIb
HD062968	G1I	F5
HD063108	F0IV	F0
HD063791	G1I	G0
HD064021	F4I	F5
HD064090	F8III	sdG2
HD064090	G3V	sdG2
HD064235	F0IV	F5IVs
HD064235	F3IV	F5IVs
HD064606	K0V	G8V
HD064630	A7V	F0
HD064649	K0I	G5
HD064685	F4I	F2IV
HD064815	G0III	F8
HD064937	M3III	K5
HD065123	F5II	F6V
HD065583	K0V	G8V
HD065604	K7III	K5
HD065874	G0III	G0
HD066011	F9V	G0IV
HD066573	G3V	G0
HD066776	K0III	G5...
HD067230	F0V	F2
HD003196	F7V	F8V...
HD003196	F7V	F8V...
HD068284	F6V	F8
HD068380	F0IV	F5
HD003229	F3IV	F5IV
HD003229	F5II	F5IV
HD070689	K5I	K5
HD070923	G0III	G0
HD070937	F3IV	F2V
HD070937	F3IV	F2V
HD070958	F3V	F3V
HD070958	F3V	F3V
HD071148	G2V	G5V
HD071155	B9III	A0V
HD071431	F9V	G0
HD071497	G5I	G5
HD071515	K2III	K0
HD071557	B6V	A0
HD071595	F0IV	F5
HD071955	K3III	K2
HD072561	G8II	G5III
HD072722	K7III	K5
HD072760	G9V	G5
HD072905	G0III	G1.5Vb
HD072945	F6V	F8V

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD072945	F7V	F8V
HD073344	F9V	F8
HD073667	G6III	K1V
HD075318	G9V	G5
HD075732	G6III	G8V
HD076151	G2IV	G3V
HD076151	G2IV	G3V
HD076932	F5II	F7/F8IV/V
HD077093	A8V	A9Vn
HD077093	A9V	A9Vn
HD077093	A9V	A9Vn
HD078362	F0IV	Am
HD078362	F0IV	Am
HD079210	M0V	M0V
HD081809	G2V	G2V
HD081809	G2V	G2V
HD081997	F3IV	F6V
HD081997	F3V	F6V
HD084021	K4III	K2
HD084607	A9V	F4IV
HD084607	A9V	F4IV
HD084937	F0IV	sdF5
HD085503	K3III	K0III
HD086728	G5IV	G1V
HD086986	A3V	A1V
HD087140	G3V	K0
HD087141	F6V	F5V
HD087141	F6V	F5V
HD088072	G2V	G0
HD088230	M0V	K8V
HD088725	G2V	G1V
HD089269	G6V	G5
HD089307	G2V	G0V
HD089507	F3IV	F2
HD089507	F3IV	F2
HD089744	F7V	F7V
HD090361	A2V	A0
HD090508	F9V	G1V
HD094028	F4V	F4V
HD094672	F3IV	F2III
HD095128	G2V	G0V
HD095735	M3III	M2V
HD096833	K2III	K1III
HD097633	A1V	A2V
HD098630	G0III	G0
HD099329	A9V	F3IV
HD099649	F0V	G5
HD099649	F0V	G5

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD100470	G8II	K0III
HD100563	F3V	F5V
HD100563	F3V	F5V
HD101177	F9V	G0V
HD101227	G7V	G0
HD102224	K0I	K0III
HD102870	G0III	F8V
HD103095	K0V	G8Vp
HD104979	G7III	G8III
HD105755	F7V	G0Vm
HD106116	G2IV	G4V
HD106210	G7V	G3V
HD106516	F5II	F5V
HD106516	F5II	F5V
HD106516	A8III	F5V
HD107705	F7V	F8V
HD108076	F9V	G0V
HD108317	G3V	G0
HD108678	F0IV	F2
HD108945	A2V	A2pvar
HD108954	G0III	F9V
HD108956	G2V	F8V
HD108986	A9V	F2
HD109358	F9V	G0V
HD109387	B5III	B6IIIp
HD109387	B4III	B6IIIp
HD110897	G0III	G0V
HD112185	A2V	A0p...
HD112185	A2V	A0p...
HD112185	A2V	A0p...
HD112185	A2V	A0p...
HD112413	A1V	A0spe...
HD112413	A1V	A0spe...
HD112413	B8III	A0spe...
HD113226	G7III	G8IIIvar
HD114710	F9V	G0V
HD114762	F7V	F9V
HD115274	F7V	G0
HD115383	F9V	G0Vs
HD116568	F3IV	F3V
HD116568	F3IV	F3V
HD117176	G6V	G5V
HD117635	K0V	G9V
HD117876	G7III	G8III
HD119850	M3III	M3V
HD122956	G9III	G6IV/Vw...
HD124292	G6V	G0
HD124425	F3IV	F7Vw

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD124425	F3IV	F7Vw
HD124850	F5II	F7V
HD124897	K1I	K1.5III
HD126053	G3V	G1V
HD126868	G3V	G2III
HD127243	K0V	G3IV
HD128167	A9V	F3Vwvar
HD132052	A8III	F0V
HD133002	G3V	F9V
HD133002	G3V	F9V
HD133208	G3I	G8III
HD133826	G0III	G0
HD134044	F7V	F8V
HD135722	G6III	G8III
HD137107	F7V	G2V
HD137107	F9V	G2V
HD137759	K2III	K2III
HD137909	A9V	F0p
HD138749	B5III	B6Vnn
HD138749	B4III	B6Vnn
HD139195	G8III	K0p
HD139798	F0V	F2V
HD140283	A8III	sdF3
HD140283	F3V	sdF3
HD140538	G6V	G5V
HD141004	G2IV	G0Vvar
HD142860	F6III	F6V
HD142926	B8V	B9p
HD142926	B8V	B9p
HD144284	F7V	F8IV-V
HD145675	G5III	K0V
HD145675	G8III	K0V
HD145729	F9V	F8
HD146233	G2V	G1V
HD147411	K1I	K0
HD147449	A9V	F0V
HD147470	A3V	A0
HD147550	A1V	B9V
HD147907	F3IV	F2
HD150177	F5II	F3V
HD150680	G2V	F9IV
HD152391	K0V	G8V
HD154359	A6V	A0
HD154443	A8V	F0
HD154543	M3III	K2
HD154797	F4III	F2
HD154931	G3V	G0
HD157089	F9V	F9V

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD157214	G1V	G0V
HD157214	G2V	G0V
HD158614	G4V	G8IV-V
HD158837	G9III	G8III
HD159181	G1I	G2II
HD159269	F0IV	F2
HD159482	F9V	G0V
HD160346	K4V	K3V
HD160454	F3V	F0
HD160933	G0III	F9V
HD161074	K5I	K4III
HD161098	G5IV	G5
HD161622	F3V	F0
HD161677	B8III	B6V
HD161797	G6III	G5IV
HD161941	A4I	B9.5V
HD162028	B8III	B6V
HD162056	A8V	F0IV
HD162178	A8III	A5
HD162651	A9I	A0
HD162652	G8II	K2
HD162691	F3IV	F2
HD162736	A8III	A2
HD162917	F5II	F4IV-V
HD162954	B8III	B8
HD163346	F5II	A3
HD163489	G8II	K2
HD163624	A6V	A3V
HD163641	B8III	B9III
HD163792	A1V	A0
HD164115	F0IV	F0
HD164115	F0IV	F0
HD164257	A3V	A0
HD164258	A3V	A3spe...
HD164259	A9V	F3V
HD164259	F0V	F3V
HD164259	A9V	F3V
HD164259	A9V	F3V
HD164259	F0V	F3V
HD164259	A9V	F3V
HD164259	F0IV	F3V
HD164259	F0V	F3V
HD164259	A9V	F3V
HD164259	F0V	F3V
HD164259	F0V	F3V
HD164557	B8III	A0
HD164967	A6V	A0
HD165146	A9V	F0

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD165173	G9V	G5
HD165341	G6III	K0V
HD165401	G0III	G0V
HD165419	K4III	K2
HD165476	G2V	G5
HD165476	G2V	G5
HD165511	A5V	A0
HD165670	F6V	F5
HD165887	A7V	A2
HD165908	F7V	F7V
HD165908	F7V	F7V
HD166072	A6V	A2
HD166073	F0IV	F2
HD166161	G9III	G5
HD166183	F5II	F8
HD166208	G1I	G8III...
HD166233	F0V	F2V
HD166257	F4III	F5
HD166283	A3V	A0
HD166285	F3V	F5V
HD166285	F6V	F5V
HD166384	A1V	A0
HD166620	G6III	K2V
HD166958	A1V	B9
HD166991	A1V	A2
HD167065	G0III	G0
HD167278	F0IV	F2
HD167808	A8III	A2
HD167858	F4I	F2V
HD167946	B9III	A0
HD168723	G5I	K0III-IV
HD168797	B5III	B3Ve
HD169006	F6V	G0
HD169032	A8III	A2
HD169725	A8III	A3
HD169822	G3V	G7V
HD170008	G9III	G5
HD170115	A3V	A0
HD170247	A0I	A0
HD170274	A8III	F0
HD170291	F4III	F5
HD170512	F8I	G0
HD166257	F6III	F5
HD170579	F5II	F5
HD170699	A7V	A2
HD170712	A4I	A0
HD170782	A3V	A2
HD170818	F0V	F2

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD170899	G8III	?G0
HD170973	B8III	A0sp...
HD170987	F0IV	F5
HD171234	A6III	A3
HD171263	A0I	A0p
HD171388	A6III	Am
HD171586	A3III	A2pvar
HD171834	F0IV	F3V
HD171834	F0IV	F3V
HD171834	F0V	F3V
HD171834	F4I	F3V
HD171834	F4I	F3V
HD171834	F4I	F3V
HD171834	A9V	F3V
HD171834	F0V	F3V
HD171834	F0V	F3V
HD171834	A9V	F3V
HD171834	F0V	F3V
HD171834	F0V	F3V
HD171834	A9V	F3V
HD181853	F3V	F2V
HD171836	F0V	F0
HD171887	K7III	K5
HD171888	F7V	F8
HD171914	A0I	A0p
HD171951	F7V	G0
HD171953	F3V	F5
HD171954	A9V	F2
HD172230	A8V	A5
HD172365	G7V	F8Ib-II
HD172426	F3IV	F2
HD172506	A9V	F2
HD172506	A9V	F2
HD172506	F4I	F2
HD172675	F5II	F8
HD172718	F7V	F8
HD172961	F0IV	F5
HD173073	A6V	A0
HD173093	F5II	F7V
HD173158	K4III	K0
HD173174	G0III	G0
HD173452	A4I	A0
HD173495	B9III	A1V
HD173566	A1V	A0
HD173667	F4III	F6V
HD173669	A3V	A0
HD174240	B9III	A1V
HD174912	G3V	F8

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD174966	A6III	A3
HD175037	A2V	A0
HD175272	F0V	F5
HD175305	G4V	G5III
HD175306	K0I	K0II-III..
HD175337	A9V	F5
HD175543	A7V	A5V
HD175805	F7V	F8
HD175805	F6V	F8
HD175806	F6III	F5
HD176074	A6V	A2
HD176232	F0III	F0spe...
HD176303	F7V	F8V
HD176437	B8III	B9III
HD177463	K2III	K1III
HD177552	A9V	F1V
HD177552	A9V	F1V
HD178266	K3III	K5
HD179315	K0I	K2
HD180028	G4V	F6Ib
HD180711	K0III	G9III
HD180945	F6V	F5
HD181096	F4III	F6IV:
HD181214	F7V	F8III
HD181526	F4III	F8
HD181853	F3V	F2V
HD181906	F5II	F8
HD182572	G6III	G8IVvar
HD182905	G9V	G5
HD183085	A9V	F0
HD184406	K3III	K3III
HD184499	G0III	G0V
HD184499	G0III	G0V
HD184499	F9V	G0V
HD184499	F9V	0V
HD184571	F3IV	F2
HD184768	G2V	G5
HD185094	A9V	F0
HD185124	F5II	F3IV
HD185144	K0V	K0V
HD185351	G5III	K0III
HD007476	F5II	F5V
HD007476	F5II	F5V
HD185657	K0III	G6V
HD185758	G4V	G0II
HD186039	F9V	F8
HD186104	G2V	G0
HD186226	F6V	F5

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD186408	G2V	G2V
HD186413	F9V	G0
HD186427	G7V	G5V
HD187003	G0III	G5
HD187111	K0I	G8III/IV _w
HD187406	F5II	F5
HD187691	G0III	F8V
HD187897	G0III	G5
HD188119	G6III	G8III
HD188405	F0IV	F2V
HD188512	G9III	G8IV _{var}
HD188947	K0III	K0III _{var}
HD189259	F3IV	F2
HD189340	F5II	F8V
HD189340	F8III	F8V
HD189478	F3IV	F0
HD189479	A0I	B9
HD189509	F7V	F5
HD189509	F6V	F5
HD189511	K0III	G5
HD189558	G3V	G0/G1V
HD189712	F3IV	F5
HD190073	A3III	Ape
HD190404	G6III	K1V
HD190412	G4V	G5
HD190437	F5II	F5
HD190498	A9V	F8
HD191026	G6III	K0IV
HD191144	K3III	K5
HD191533	F3V	F8
HD191548	F0IV	F2
HD191709	F3IV	F0
HD191984	A1V	A0
HD192586	F0IV	F5
HD192895	A8III	F2
HD193225	F0V	F0
HD193326	G9III	G5
HD193374	F5II	F8
HD193581	F0IV	F0
HD194244	B8III	B9V
HD194452	A6V	A2
HD194453	A1V	A0
HD194598	F7V	F7V-VI
HD195005	F7V	G0
HD195104	F6V	F8
HD194154	F3V	F5
HD195198	B8III	A0
HD195533	F0IV	F0

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD195533	A9V	F0
HD195617	K5I	K2
HD195633	F9V	G0Vm
HD195634	F5II	F2
HD195729	A6III	A2
HD196125	A8III	F0
HD196203	F6V	F8
HD196218	F5II	F8
HD196346	K3III	G9III
HD196426	B9I	B8IIp
HD196755	G6V	G5IV+...
HD197832	A3V	A0
HD197832	A3V	A0
HD197964	G8II	K1IV
HD197967	F7V	F2
HD197989	K0III	K0III
HD198023	F3IV	F2
HD198061	F3V	F5
HD198149	G6III	K0IV
HD198809	G6III	G8III
HD199766	F5II	F5III...
HD199766	F5II	F5III...
HD199870	K0III	G8III
HD199960	G2IV	G1V
HD200081	G9V	G0
HD200375	F6III	F5V
HD200375	F3V	F5V
HD200494	K1I	K0
HD200580	F7V	F9V
HD200790	F7V	F8V
HD200790	F7V	F8V
HD200905	M1I	K5Ib...
HD201053	K0III	K0
HD201091	K4III	K5V
HD201092	M0V	K7V
HD201099	F9V	G0
HD201221	A3V	A2
HD201377	A6V	A3
HD201889	G3V	G1V
HD201891	F7V	F8V-VI
HD202109	K0III	G8II...
HD203235	F7V	F8
HD203387	G6III	G8III
HD203454	F9V	F8V
HD203522	G3V	F8
HD204155	F9V	G5
HD204543	G9III	G0
HD204613	G3V	G0IIIwsp

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD204867	G9III	G0Ib
HD205435	G3I	G8III
HD205512	G5I	K1III
HD205555	F0IV	F0
HD205702	F9V	F8
HD205734	A6III	F0
HD205811	A1V	F2V
HD206778	K5I	K2Ibvar
HD206859	K0I	G5Ib
HD206862	F3V	F8
HD207130	G5I	K0III
HD207978	F5II	F6IVwvar
HD207978	F4V	F6IVwvar
HD207978	F3V	F6IVwvar
HD208906	F7V	F8V-VI
HD209472	F3V	F5
HD209750	G8III	G2Ib
HD209763	F0IV	F5
HD209763	A9V	F5
HD209965	F7V	F8V
HD210752	G0III	G0
HD210807	G3I	G8III
HD212754	F7V	F7V
HD212754	F7V	F7V
HD212943	G8II	K0III
HD213235	F5II	F5IVs
HD214132	F3IV	F0
HD214448	K0V	G1IV-V
HD214567	G3I	G8II
HD215648	F4III	F7V
HD215665	K0III	G8II-III
HD216131	G3I	M2III
HD216143	G6III	G5
HD216174	K0I	K1III
HD216228	K0III	K0III
HD216385	F6V	F7IV
HD217014	G2V	G5V
HD217107	G9V	G8IV
HD217476	G1I	G0Iab:
HD217927	F5II	F2
HD218059	F3V	F8
HD218209	G2V	G6V
HD218502	B1I	F3:w
HD218857	G4V	G6:w...
HD219134	K4V	K3Vvar
HD219449	K2III	K0III
HD219615	G6III	G7III
HD219617	F7V	F8:w

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD219617	F7V	F8:w
HD219623	F7V	F7V
HD219877	F3IV	F3IV
HD219877	F3IV	F3IV
HD219916	G6III	K0III
HD220954	G5I	K1III
HD221170	G9II	G2IV
HD221345	K0III	K0III
HD221377	F3V	F7Vm
HD221585	G5IV	G8IV
HD221830	G3V	F9V
HD221950	F5II	F6Vbwvar
HD221950	F5III	F6Vbwvar
HD222107	G8II	G8III-IV
HD222368	F7V	F7V
HD222368	F7V	F7V
HD222368	F7V	F7V
HD222404	G5I	K1IV
HD223707	A3III	A2
HD224315	F4I	F0
HD224315	A8III	F0
HD224431	F5II	F8
HD224559	B5III	B4Vne
HD224559	B4III	B4Vne
HD224617	F5II	F4IV
HD224617	F5II	F4IV
HD224639	F0V	F0
HD224930	G3V	G3V
HD224945	A8III	A3
HD225239	G3V	G2V
HD232078	M1I	K3IIp
HD338529	F0V	B5
HD345957	F6III	G0Vwe
BD+023375	A9V	A5
BD+023375	A9V	A5
BD+044551	F6III	F7Vwe
BD+174708	F3V	sdF8
BD+233130	G3V	G0
HD345957	F4III	G0Vwe
BD+251981	F0V	F0
BD+290366	G3V	F8V
BD+292290	G2V	G5
BD+302611	K0I	G8III
HD025893	G6III	G5
BD+413931	F7V	G5
BD+442051	M3III	M2Vvar
BD+461635	M0V	K7V
BD+463471	B4V	B9.5Ve

Table 7. Continued.

Star Name	ANN Class	Catalog Class
BD+660268	G3V	G0
BD+720094	F0IV	sdF2:
BD-004234	G6III	K3Ve+...
BD-185550	G9III	G0
HD039681	A9V	B9
HD080715	K4V	K2V
HD089269	G2V	G5
HD101206	K4V	K5V
HD108954	F7V	F9V
HD118096	K4V	K5IV
HD119802	K4V	K2
HD119802	K4V	K2
HD122064	K4V	K3V
HD122120	K4III	K
SUN	G3V	G2V
SUN	G3V	G2V
SUN	G2V	G2V
SUN	G2V	G2V
SUN	G2V	G2V
SUN	F9V	G2V
SUN	F9V	G2V
BD+024651	F5V	F5
BD+133683	G4V	F5
BD+203603	F0IV	F0
BD+292091	F3IV	F5
BD+321561	G6III	K2V
BD+362165	F0IV	G0
BD+412695	M0V	M0
BD+423607	F5V	F3
BD+473452	A3V	A2V
BD+473454	A3V	A2V
BD+473458	A1V	A1V
BD+473458	A1V	A1V
BD+780830	M7II	M0
BD-040782	K3III	K5V
HD000108	B7I	O6pe
HD000108	A3I	O6pe
HD000144	A0I	B9III
HD000245	G0III	G2V
HD000432	F0V	F2III-IV
HD000560	A1V	B9V
HD000842	F5II	A9Iab:
HD000886	B8I	B2IV
HD000886	B3III	B2IV
HD001280	A3V	A2V
HD001400	K4III	K7Iab:
HD001562	G3V	G0
HD001835	M3II	G3V

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD002506	G6III	G4III
HD002628	A8III	A7III
HD003360	B3III	B2IV
HD003369	B8III	B5V
HD003546	K0V	G5III...
HD003628	G5IV	G2V
HD003651	G6III	K0V
HD003765	G8II	K2V
HD003765	G8II	K2V
HD003883	A8V	A7m
HD004614	F9V	G0V...
HD004628	K0III	K2V
HD004778	A3III	A0p...
HD004813	F5V	F7IV-V
HD004813	F7V	F7IV-V
HD005015	F7V	F8V
HD005286	G8II	K1IV
HD005294	G3V	G5
HD005294	G3V	G5
HD214167	B5III	B2Ve
HD005394	B5I	B0IVe
HD005395	G6III	G8III-IV
HD005448	A7V	A5V
HD005448	A7V	A5V
BD+362219	M3III	M1
HD005857	G8II	G5
HD006755	G4V	F8V
HD006695	A6V	A3V
HD006715	G3V	G5
HD006860	K7III	M0IIIvar
HD006961	A7V	A7Vvar
HD007351	M3III	M2S...
HD007374	B6V	B8III
HD008538	A6V	A5V...
HD008574	F9V	F8
HD008648	G2IV	G5
HD008992	G9V	F6Ib
HD009472	G3V	G0
HD009826	G0III	F8V
HD009919	A9V	F0V
HD009973	G4V	F5Iab
HD010086	G7V	G5IV
HD010086	G7V	G5IV
HD010307	G2V	G2V
HD010476	G6III	K1V
HD010780	G9V	K0V
HD011007	F9V	F8V
HD011257	F4I	F2Vw

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD011636	A6V	A5V...
HD011926	G2V	G5
HD011946	A1V	A0Vn
HD011973	A8III	F0V
HD012216	A5V	A2V
HD012846	G3V	G2V
HD013041	A6V	A5IV-V
HD013174	A9V	F2III
HD013267	F2I	B5Ia
HD013268	B8I	O8Vnn
HD013403	G3V	G3V
HD013507	G3V	G0
HD013555	F3IV	F5V
HD013825	G7V	G8IV
HD013974	G3V	G0V
HD014191	A1V	A1Vn
HD014221	F3IV	F4V
HD014633	O7.5V	O8.5V
HD014802	F9V	G2V
HD014947	A9V	O6e...
HD015335	F9V	G0V
HD015558	F4I	O5e
HD015570	F6III	O4...
HD015629	F4I	O5e
HD015753	G4V	G0
HD015830	G3V	G0
HD015866	G2IV	G0III
HD016232	F4III	F4V
HD016429	F6III	O9.5III
HD016429	F6III	O9.5III
HD016429	F6III	O9.5III
HD017145	G3V	B8Ia
HD017378	G4V	A5Ia
HD017674	F9V	G0V
HD017905	F7V	F5
HD018144	K0V	G5
HD018191	M7II	M6IIIvar
HD018409	F4I	O9Ib
HD018803	G6V	G8V
HD020630	G2V	G5Vvar
HD020771	F7V	G0
HD021183	G2IV	F9V
HD021183	G3V	F9V
HD021183	G3V	F9V
HD022468	G6III	G5IV-V+...
HD022468	G6III	G5IV-V+...
HD023050	G3V	G2V
HD023050	F9V	G2V

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD023862	B4III	B7p
HD023862	B5III	B7p
HD023862	B5III	B7p
HD023862	B5I	B7p
HD023862	B5I	B7p
HD023862	B5III	B7p
HD023862	B5III	B7p
HD023862	B5III	B7p
HD023862	B5I	B7p
HD023862	B3I	B7p
HD023862	B8I	B7p
HD023862	B8I	B7p
HD023862	B5I	B7p
HD023862	B5III	B7p
HD023862	B5III	B7p
HD023862	B5III	B7p
HD023862	B5III	B7p
HD023862	B5III	B7p
HD023862	B5III	B7p
HD023862	B5III	B7p
HD023862	B5III	B7p
HD024040	G7V	G0
HD024206	G6V	G0
HD024496	K0V	G0
HD024534	B8I	O9.5pe
HD024534	B8I	O9.5pe
HD024912	B5I	O7.5Iab:
HD026756	G5IV	G5V
HD026913	G7V	G5IV
HD026923	F9V	G0IV...
HD026965	K0V	K1V
HD027282	G2III	G8V
HD027685	G2V	G4V
HD028447	G6V	G5
HD029150	G6V	G5
HD029645	F9V	G0V
HD031412	F9V	F8
HD032259	G3V	G0
HD033021	G3V	G1IV
HD033632	F7V	F8
HD034078	A3I	O9.5Vvar
HD034078	A3I	O9.5Vvar
HD082969	G5III	G5
HD034878	K0III	G8IV
HD035961	G2V	G1V
HD036066	F9V	F8V
HD036215	F9V	F8

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD036667	F9V	F8
HD037124	G4V	G4IV-V
HD037124	G4V	G4IV-V
HD038230	G6III	K0V
HD038528	A6V	A0
HD038650	A1V	B9
HD038798	A1V	A0...
HD038856	B4V	B8
HD039082	A1V	B9
HD039773	B8III	B9...
HD040616	G3V	G0
HD040616	F9V	G0
HD040650	F9V	F5
HD040964	B9III	B8V
HD041330	F9V	G0V
HD041361	K0III	G7III:
HD041361	K0III	G7III:
HD041380	G8III	G4III
HD041433	G1I	K0
HD041460	K7III	K5
HD041501	A0I	B9
HD041547	A9V	F4V:
HD041547	F0V	F4V:
HD041593	K0V	K0
HD041593	K0V	K0
HD041733	K3III	K2
HD041770	F3IV	F2
HD041808	A0I	A0
HD042035	B8III	B9V
HD042089	G9III	G0
HD042092	A1V	A0
HD042092	A1V	A0
HD042111	A1V	A3Vn
HD042256	G5I	K0
HD042278	F4I	F3IV _w
HD042278	A9V	F3IV _w
HD042299	A8III	A3
HD042317	K2III	G5
HD042353	B4V	B9
HD042353	B6V	B9
HD042481	K4III	K2
HD042548	F0IV	F0
HD042597	B5III	B1V
HD042618	G3V	G4V
HD042618	G5IV	G4V
HD042773	M1I	K5
HD042787	M3III	M...
HD042807	G3V	G8V

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD042807	G3V	G8V
HD042983	G8II	K0
HD043021	A9V	A0
HD043039	K0III	G8IIIvar
HD043083	G6III	K0
HD043188	G8III	K0
HD043264	B8III	B9
HD043285	B4III	B6V
HD043285	B8III	B6V
HD043286	B4III	B5
HD043318	F5II	F6V
HD043338	F0IV	F0
HD043021	A8III	A0
HD043338	A9V	F0
HD043523	F9V	F5
HD043526	B1III	B7III
HD043588	K7III	K2
HD043776	K3III	K0
HD043856	F7V	F6V
HD043947	F7V	F8V
HD044109	B8V	B9
HD044195	A9V	F0
HD044256	K4III	K2
HD044274	M5III	M...
HD044333	A8V	A4.5V
HD044515	K4III	K0
HD044602	A3V	A3
HD044614	G2V	G0
HD044716	G4V	F5
HD044769	A6V	A5IV
HD044783	B8III	B8Vn
HD044947	A8III	A3
HD045152	G7III	G5
HD045196	F3IV	F0
HD045211	K0III	K0
HD045317	G8II	G5
HD045355	M1I	K5
HD045391	G3V	G0
HD045415	K0III	G9III
HD045416	K2III	K1II
HD045507	G6III	G5
HD045514	K4III	K2
HD046122	K0V	G3IV
HD046199	F0III	A3
HD046301	F3V	F5V
HD046304	A3III	F0Vnn+...
HD046304	A4I	F0Vnn+...
HD046304	A1V	F0Vnn+...

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD046304	A7V	F0Vnn+...
HD046304	A1V	F0Vnn+...
HD046304	F4I	F0Vnn+...
HD046304	F0III	F0Vnn+...
HD046304	A3III	F0Vnn+...
HD046304	A3III	F0Vnn+...
HD046377	M1I	K4III
HD046380	B2III	B2Vne
HD047127	G4V	G5
HD047309	G2V	G0
HD047309	G3V	G0
HD047530	G6III	G5
HD048616	G4V	F5Ib
HD042143	A6V	A0
HD049367	K2III	K1II
HD049385	F8I	G0
HD049434	A8III	F1V
HD049434	A8III	F1V
HD049434	F0V	F1V
HD049434	F0III	F1V
HD049434	F0V	F1V
HD049641	K3III	K0
HD049739	A8III	A5
HD050084	K0III	K2
HD050167	K5I	K5
HD050209	B7I	B9Ve
HD050229	K0I	K5
HD050277	A8III	F0Vn
HD050277	A8III	F0Vn
HD050277	A6III	F0Vn
HD050372	G5I	G6II
HD050554	F9V	F8
HD049330	F3I	B0:nnpe
HD050696	B5I	B1:V:nne
HD050794	A9V	F0
HD050819	G6III	K0
HD051105	K2III	G5
HD051219	G7V	G8V
HD051219	G2V	G8V
HD051219	G5IV	G8V
HD051419	G3V	G5V
HD051419	G3V	G5V
HD052010	F5III	F5
HD053003	K0V	G0Ib
HD053451	K0III	K0
HD054079	K0I	K0III:
HD054217	A1V	A0
HD054357	A6III	A0

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD054371	G7V	G8V
HD054489	K3III	G9III
HD054619	K5I	K2
HD054632	K5I	K2
HD054828	K0V	G5
HD054908	F0V	A0
HD055011	K5I	K2
HD055575	G0III	G0V
HD055583	K2III	K0
HD055606	B2III	B1:V:npe
HD055828	M3III	M...
HD055973	A9V	F2
HD056079	K5I	K2
HD056303	F9V	G0
HD056303	G2V	G0
HD056394	F5II	F2
HD100284	A9V	F8
HD056359	F0III	A2
HD056448	G3I	K0
HD056515	F9V	G0
HD056539	K7III	K5
HD056793	K0III	K0
HD056891	G8II	K0
HD057006	F7V	F8V
HD057006	F7V	F8V
HD057006	F7V	F8V
HD057132	K4III	K0
HD057275	B9III	B9
HD057313	G8III	G5
HD057707	K0III	G5
HD057838	G1I	K2
HD058051	K5I	K0
HD058072	G3I	G5
HD058207	K0III	G9III+...
HD058368	K0III	K0
HD058369	M1I	K5
HD058431	F0V	F0
HD058455	K3III	K0
HD058500	K0III	K0
HD058554	K3III	K0
HD058595	G4V	G5
HD058714	K4III	K0
HD058781	G6V	G5
HD058923	A7V	F0III
HD059061	K0III	K0
HD059090	F4III	F8
HD059227	G8III	G5
HD059295	G5I	K0

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD059380	F5II	F8V
HD059380	F5II	F8V
HD059473	F0III	A5
HD059511	K4III	K0
HD059984	F6III	F5V
HD059984	F6V	F5V
HD060408	K0V	G5
HD060501	M4III	M...
HD061606	G8II	K2V
HD061935	K0III	K0III
HD062345	G3I	G8III
HD062346	G3V	G5
HD062509	G8III	K0IIIb
HD062613	G6V	G8V
HD063433	G7V	G5IV
HD063436	A9V	F2
HD063798	G7III	G5
HD115268	A8III	A3
HD065372	A4I	A3
HD066011	F7V	G0IV
HD066090	K5I	K2
HD067230	F0IV	F2
HD067589	A9V	F0
HD067767	K0V	G8IV
HD068017	G3V	G4V
HD068638	G9V	G8V
HD068638	K0V	G8V
HD070093	K4III	K0
HD070110	F9V	F9V
HD070110	F9V	F9V
HD070298	F0IV	F2
HD070458	K5I	K5
HD070494	K5I	K5
HD070757	A9V	F0
HD071148	G2V	G5V
HD071262	B7III	A0
HD071310	A9I	A2
HD128661	A6III	F0V
HD071640	F7V	F5
HD071881	G2V	G1V
HD072097	A8III	F0
HD072946	G6V	G5V
HD072946	G6V	G5V
HD073108	K2III	K2III
HD073226	G3V	G5
HD073226	G3V	G5
HD073344	F9V	F8
HD073344	F9V	F8

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD073667	G6III	K1V
HD073668	G2V	G1V
HD073668	F9V	G1V
HD074011	G3V	F8
HD074156	F9V	G0
HD074156	G0III	G0
HD074280	B3III	B3V...
HD074280	B2III	B3V...
HD075302	G7V	G0
HD075732	G6III	G8V
HD075933	G3V	G5
HD076294	K0III	G8III-IV
HD076752	G3V	G2V
HD076780	G6V	G5
HD077350	B8III	A0III
HD078175	F5II	F5V
HD079469	B9III	B9.5V
HD079469	B9III	B9.5V
HD079555	K4V	K0
HD079555	K4V	K0
HD080536	G2V	G0
HD080607	G5III	G5
HD080607	G6III	G5
HD149419	F3IV	G0
HD081192	G5III	G7III
HD082106	K4V	K3V
HD082106	K4V	K3V
HD082885	G9V	G8IV-V
HD084737	G2IV	G2V
HD085235	A3V	A3IV
HD085235	A3V	A3IV
HD085503	K3III	K0III
HD086133	F9V	G0
HD086133	F9V	G0
HD086560	F9V	F8
HD087737	B5I	A0Ib
HD088072	G3V	G0
HD088609	G0I	G5IIIwe
HD088986	G2V	G0V
HD089010	M5V	G2IV
HD089251	G3V	G0
HD089307	G2V	G0V
HD089307	G2V	G0V
HD089389	F9V	F9V
HD089744	F7V	F7V
HD090343	K0V	K0
HD090507	G6III	G5
HD091347	F9V	F8

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD091347	F9V	F8
HD091752	F3V	F3V
HD092127	F3IV	F5
HD094587	G5III	G5
HD095128	G2V	G0V
HD095128	G2V	G0V
HD096094	F9V	G0
HD096094	A8III	G0
HD096094	G3V	G0
HD097711	G3V	G0
HD097711	G3V	G0
HD097778	M3III	M3III
HD097916	F3IV	F5V
HD098630	F9V	G0
HD099491	G6III	K0IV
HD099491	G9III	K0IV
HD099505	G3V	G5
HD100284	F0IV	F8
HD101177	G2V	G0V
HD101242	G7V	G5
HD101501	G9V	G8Vvar
HD101690	G2V	G0
HD103095	K0V	G8Vp
HD103095	K0V	G8Vp
HD105087	G9III	K0
HD105546	G2V	G2IIIm
HD106116	G2III	G4V
HD106252	G2V	G0
HD107213	F7V	F8Vs
HD107213	F7V	F8Vs
HD107700	F5III	F8:p...
HD107700	F6V	F8:p...
HD107700	F5III	F8:p...
HD107700	F5III	F8:p...
HD107700	F5III	F8:p...
HD108134	F9V	G0p
HD108956	G2V	F8V
HD109358	G2V	G0V
HD110184	K7III	G5
HD110833	G8II	K3V
HD111398	G7V	G5V
HD111812	G2V	G0III
HD112185	A2V	A0p...
HD112185	A2V	A0p...
HD112185	A2V	A0p...
HD112185	A1V	A0p...
HD112185	A2V	A0p...
HD112185	A2V	A0p...

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD112185	A2V	A0p...
HD112185	A1V	A0p...
HD112185	A2V	A0p...
HD112185	A2V	A0p...
HD112185	A1V	A0p...
HD112185	A1V	A0p...
HD112185	A2V	A0p...
HD112185	A1V	A0p...
HD112185	A2V	A0p...
HD112185	A2V	A0p...
HD112185	A1V	A0p...
HD112185	A1V	A0p...
HD112185	A1V	A0p...
HD112735	F9V	G0
HD112758	G9III	K0V
HD113319	G3V	G8IV
HD114174	G7V	G5IV
HD115268	A8V	A3
HD115268	A8V	A3
HD115274	F7V	G0
HD115404	K0I	K2V
HD116442	K0V	G5
HD116443	G6III	G5
HD116443	G6III	G5
HD116515	K0III	K0
HD117043	G9V	G6V
HD117176	G4V	G5V
HD118022	A3III	A1p...
HD118022	B2III	A1p...
HD119550	G3V	G2V
HD120066	G2V	G0V
HD120066	G2V	G0V
HD120136	F6V	F7V
HD122064	K4V	K3V
HD122563	G0I	F8IV
HD124320	A6V	A2V
HD124320	A6V	A2V
HD125184	G6V	F9V
HD126031	A9V	A2
HD126246	F9V	F5
HD126246	F9V	F5
HD126323	F9V	G0
HD126512	G3V	F9V
HD126512	F9V	F9V
HD126512	G0III	F9V
HD127243	K0V	G3IV
HD127506	K4V	K3V
HD128165	K4V	K3V

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD129499	F9V	G5
HD129814	G2V	G5V
HD130322	G9V	K0III
HD130322	G9V	K0III
HD131042	G3V	G5
HD131977	K3III	K4V
HD132142	K0V	K1V
HD133002	G3V	F9V
HD134083	F3IV	F5V
HD134083	F3IV	F5V
HD134169	F5II	G1Vm
HD135101	G6V	G5V
HD135101	G6V	G5V
HD135101	G6V	G5V
HD135204	G9V	K0V
HD135599	K0V	K0
HD136202	F7V	F8III-IV
HD136512	G7III	K0III
HD136512	G7III	K0III
HD136512	G7III	K0III
HD136512	K0III	K0III
HD136512	K0III	K0III
HD136923	G9V	K0
HD136923	G9V	K0
HD136923	G9V	K0
HD137107	F9V	G2V
HD137909	A8V	F0p
HD137909	A8V	F0p
HD137909	A9V	F0p
HD137909	F0III	F0p
HD137909	F0III	F0p
HD137909	A8V	F0p
HD137909	F0III	F0p
HD137909	F0III	F0p
HD137909	F0III	F0p
HD137909	A8V	F0p
HD137909	A8V	F0p
HD137909	A8V	F0p
HD137909	A8V	F0p
HD137909	F0III	F0p
HD137909	F0III	F0p
HD138573	G6V	G5IV-V
HD139323	G8II	K3V
HD139324	G2V	G5
HD139341	G6III	K2V
HD139341	G6III	K2V
HD139341	G6III	K2V
HD139341	G6III	K2V
HD140233	G3V	G0

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD141272	K0V	G8V
HD142091	G8III	K0III-IV
HD142091	G8III	K0III-IV
HD142091	G8III	K0III-IV
HD142091	K0III	K0III-IV
HD142373	F9V	F9V
HD143213	A6V	A0
HD034200	G5III	G5
HD143761	G2V	G2V
HD144206	B6V	B9III
HD144287	G9V	G8V
HD144579	G4V	G8V
HD144579	G4V	G8V
HD144579	G4V	G8V
HD144579	G4V	G8V
HD145389	B6V	B9MNp...
HD145675	G8III	K0V
HD145742	K0III	K0
HD148856	G1I	G8III
HD148856	G1I	G8III
HD148856	G1I	G8III
HD149661	G9III	K2V
HD150680	G2V	F9IV
HD150997	G3I	G8III-IV
HD150997	G3I	G8III-IV
HD150997	G3I	G8III-IV
HD150997	G5III	G8III-IV
HD151541	K0V	K1V
HD066444	G6III	K0
HD066444	G6III	K0
HD154345	G9V	G8V
HD154345	G6V	G8V
HD155763	B6V	B6III
HD155763	B8V	B6III
HD156729	A3V	A2V
HD156729	A3V	A2V
HD157857	B7I	O7e
HD157881	M0V	K7V
HD157881	M0V	K7V
HD158633	K0V	K0V
HD158633	G6III	K0V
HD159062	K0V	G5
HD159062	G4V	G5
HD159222	G2V	G5V
HD159307	A8V	F8
HD159909	G5IV	G5
HD160693	F9V	G0V
HD161074	K5I	K4III

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD161096	K2III	K2III
HD161270	A2V	A1IV-V
HD161289	A1V	A0V
HD161289	A1V	A0V
HD161289	A1V	A0V
HD161370	A8III	A0
HD161370	F0V	A0
HD161587	K5I	?K2
HD161587	K5I	?K2
HD161750	A8III	F0
HD161797	G6III	G5IV
HD161868	B9III	A0V
HD161868	A1V	A0V
HD162163	M4III	K5
HD162211	K2III	K2III
HD162651	A9I	A0
HD162651	A9I	A0
HD162651	A9I	A0
HD162691	F0IV	F2
HD162753	M5III	M...
HD163311	M1I	?K2
HD163588	K2III	K2III
HD163610	K7III	?K5
HD163611	F5II	F4Vvar
HD163611	F3IV	F4Vvar
HD163611	F3V	F4Vvar
HD163826	M1I	K5
HD163993	G3I	K0III
HD163993	G5III	K0III
HD164058	K5I	K5III
HD164058	K5I	K5III
HD164115	F0IV	F0
HD164259	F4I	F3V
HD164259	F4I	F3V
HD164259	F4I	F3V
HD164259	A9V	F3V
HD164259	A9V	F3V
HD164259	A8III	F3V
HD164259	F4I	F3V
HD164259	F4I	F3V
HD164259	A9V	F3V
HD164259	A9V	F3V
HD164259	A9V	F3V
HD164259	A9V	F3V
HD164259	A9V	F3V
HD164259	A9V	F3V
HD164259	F4I	F3V
HD164285	G6III	K0
HD164353	B5I	B5Ib

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD164651	G6V	G5
HD164651	G5IV	G5
HD164922	G6III	K0V
HD165146	F0V	F0
HD165173	G6V	G5
HD165195	K0I	K3p
HD165195	K7III	K3p
HD165341	K0V	K0V
HD165341	G9III	K0V
HD165341	G9III	K0V
HD165672	G2V	G5
HD166620	G6III	K2V
HD166734	G0I	O8e
HD166782	K3III	K2
HD166782	K3III	K2
HD166782	K3III	K2
HD167006	M3III	M3III
HD167006	M3III	M3III
HD167218	K5I	K5
HD167218	K5I	K5
HD167241	K4III	?K0
HD167392	A0I	B9
HD167676	K0III	K0
HD168009	G3V	G2V
HD168009	G2V	G2V
HD168413	M1I	K5
HD168720	K7III	M1III
HD168720	K7III	M1III
HD168723	G8III	K0III-IV
HD169267	K0III	K0
HD169268	F0V	F6III-IV
HD169268	F4I	F6III-IV
HD169268	F4I	F6III-IV
HD169931	M7II	M7
HD169959	A3V	A0III
HD169986	F5II	F5V
HD170009	A0I	B8
HD170053	K3III	K2II
HD170270	K5I	K5
HD170291	F7V	F5
HD170413	K0I	K2
HD170739	F0V	B8
HD170780	K7III	?K5
HD170783	A0I	B5
HD170783	A0I	B5
HD170785	K0III	K0
HD171067	G7V	G8V
HD171089	M1I	K5

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD171170	K3III	K2
HD171304	F8III	G5
HD171304	G2V	G5
HD171367	K0I	K0
HD171802	F3IV	F5III
HD171834	F4I	F3V
HD171834	F4I	F3V
HD171834	F4I	F3V
HD171834	A9V	F3V
HD171834	F4I	F3V
HD171834	A9V	F3V
HD171834	F0V	F3V
HD171917	K2III	K0
HD171917	K2III	K0
HD171917	K2III	K0
HD171952	M1I	K5
HD171995	K4III	?K2
HD172167	A1V	A0V
HD172167	A1V	A0V
HD172167	A1V	A0V
HD172171	M5III	K1III+...
HD172472	K0I	K2
HD172488	A9V	B0.5V
HD172488	F4I	B0.5V
HD172488	F5II	B0.5V
HD172522	A9I	A2III
HD172588	A8V	F0II-III
HD172588	F3IV	F0II-III
HD172675	F3V	F8
HD172748	F0IV	F2IIIp
HD172786	K2III	K0
HD173005	K4III	K2
HD173034	K3III	K0
HD173216	F7V	F8
HD173328	G9III	K2
HD173329	M4III	M...
HD173369	A8V	A2
HD173611	A7V	A0
HD173634	F6V	F5
HD173667	F4V	F6V
HD173673	B8III	B8
HD173701	G5III	K0
HD173799	M4III	M...
HD173819	K3III	K0Ibpvar
HD174069	A0I	B1.5V
HD174350	G5I	K1III
HD174512	F5II	B8
HD174515	K3III	K0

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD174701	B6V	B9
HD174704	F6III	F1Vp
HD174719	G6V	G6V
HD174866	A9I	A7Vn
HD174866	A9I	A7Vn
HD174866	A7V	A7Vn
HD174866	A6V	A7Vn
HD174884	A1I	B8
HD174913	K5I	?K2
HD175015	A3III	A0
HD175058	A8III	A2
HD175100	M4III	M...
HD175181	K0III	G5
HD175225	G6III	G9IVa
HD175225	G6III	G9IVa
HD175272	F0IV	F5
HD175337	A9V	F5
HD175337	A9V	F5
HD175337	A9V	F5
HD175376	K4III	K2
HD175543	A7V	A5V
HD175588	M4III	M4IIvar
HD175638	A6V	A5V
HD175639	A7V	A5Vn
HD175726	F9V	G5
HD175786	M3III	K5
HD175806	G0III	F5
HD169985	F7V	G0III+...
HD175900	G0III	G5
HD176112	A6III	F0
HD176112	A7V	F0
HD176118	F3IV	F8
HD176488	K3III	K2
HD176630	A0I	B4IV
HD176698	G5I	K0
HD176737	K5I	K4II-III
HD176841	G7V	G5
HD176841	G2V	G5
HD176851	F5III	F5
HD177028	G8II	K0
HD177089	K5I	K2
HD177257	K4III	K2
HD177282	K4III	K5
HD177495	K4III	K2
HD177702	A8V	F0
HD177749	F6V	F5...
HD177756	B7III	B9Vn
HD177904	F3IV	F2+...

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD177904	F3IV	F2+...
HD177942	K5I	K5
HD178165	G5I	K3III-IV
HD178265	F0V	F0
HD178287	G8II	G5
HD178359	G8II	?F5IV
HD178574	F4V	F5
HD178596	A8V	F0III-IV
HD179079	G7V	G5
HD179104	K5I	?K0
HD179124	A0I	B9
HD179406	B9I	B3V
HD179761	B6V	B8II-III
HD179791	A3V	A3V
HD180029	A2I	?A2
HD180086	F0V	F0
HD180163	B5III	B2.5IV
HD180590	K0III	K0
HD180711	K0III	G9III
HD180896	G5I	K0
HD180973	F0IV	F0
HD181096	F4III	F6IV:
HD181366	K0III	K0
HD181414	A6III	A2
HD181420	F3IV	F2
HD181440	A1V	B9III
HD181475	M1I	K5II
HD181527	A8III	A2
HD181655	G7V	G8V
HD181806	F3V	F5
HD182488	G9III	G8V
HD182640	F0III	F0IV
HD182640	F0III	F0IV
HD182640	F0III	F0IV
HD182640	F0III	F0IV
HD182736	K0V	G0
HD182736	K0V	G0
HD183341	G2V	G5
HD183341	F9V	G5
HD184385	G6III	G5V
HD184406	K2III	K3III
HD184499	G3V	G0V
HD184663	F0V	F6IV
HD184663	A9V	F6IV
HD184663	A9V	F6IV
HD184786	M4III	M4.5III
HD185144	K0V	K0V
HD185758	G4V	G0II

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD186379	F9V	F8V
HD186379	F7V	F8V
HD186980	B8I	O7.5...
HD187123	G2V	G5
HD187691	G0III	F8V
HD187923	G3V	G0V
HD187923	G2IV	G0V
HD188056	K3III	K3IIIvar
HD188209	B2I	O9.5Ia
HD188326	G9V	G8IVvar
HD188326	K0V	G8IVvar
HD188510	F8III	G5Vwe
HD189087	K0V	K1V
HD190007	K3III	K4V
HD190007	K4III	K4V
HD190067	K0V	G7V
HD190228	K0V	G5IV
HD190228	K0V	G5IV
HD190229	B4V	B9MNp...
HD190229	B4V	B9MNp...
HD190360	G9V	G6IV+...
HD190864	A3I	O7III...
HD191026	G5III	K0IV
HD191692	B8V	B9.5III
HD192639	F4I	O8e
HD193793	M3II	WC+...
HD193793	M3II	WC+...
HD193793	M3II	WC+...
HD193793	M3II	WC+...
HD194093	G5IV	F8Ib
HD194388	A7I	F0
HD195034	G3V	G5
HD195592	F8V	O9.5Ia
HD195634	A9V	F2
HD196426	B8III	B8IIIp
HD196755	G7V	G5IV+...
HD196867	A1V	B9V
HD196991	F5II	G0
HD197076	G3V	G5V
HD197076	G3V	G5V
HD199191	K0III	G8III+...
HD199579	B7I	O6...
HD200375	F6V	F5V
HD201092	M0V	K7V
HD201092	M0V	K7V
HD201547	G4V	G0
HD202108	G2V	G0
HD202124	F3I	O9.5Ib

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD203839	F3V	F0
HD204521	F9V	G5
HD205073	A1V	A1p
HD205117	B9III	A1p
HD205198	A1V	A1.5Vp
HD205331	A1V	A1III
HD206088	F0V	A7III:mp..
HD206165	A3I	B2Ib
HD206374	G4V	G8V
HD206374	G7V	G8V
HD207795	G6III	K2
HD209459	B9III	B9.5V
HD209975	B5I	O9.5Ib
HD209993	A3V	A3V
HD210460	G4V	G0V
HD210460	G3V	G0V
HD210667	G5III	K0
HD210807	G3I	G8III
HD210809	B8I	O9Ib
HD210839	A3I	O6e
HD211336	F0III	F0IV
HD211472	K0V	K1V
HD212061	A1V	A0V
HD212076	B5III	B2IV-V
HD212454	B4III	B8III-IV
HD212571	B2.5III	B1Ve
HD212943	G8II	K0III
HD213307	B9I	A0
HD213420	B2I	B2IV
HD213470	F3V	A3Ia...
HD213558	A1V	A1V
HD214132	F0IV	F0
HD214168	B5III	B2V
HD224544	B5III	B6IVe
HD214680	O9V	O9V
HD214680	O7.5V	O9V
HD214923	B8III	B8.5V
HD214923	B6V	B8.5V
HD214994	A1V	A1IV
HD215065	G2V	G5
HD215648	F6V	F7V
HD215704	G6III	K0
HD216131	G6III	M2III
HD216219	G3V	G0IIp
HD216385	F4III	F7IV
HD216572	F7V	A0...
HD216672	M4III	S...
HD216735	B9III	A1V

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD216831	B8III	B7III
HD216916	B2.5III	B2IV
HD217086	F6III	O7n
HD217754	A9V	F2IV
HD217833	B8III	B9IIIwe...
HD217891	B5III	B6Ve
HD217906	M3III	M2II-IIIva
HD218045	A1V	B9.5III
HD218209	G3V	G6V
HD218329	K7III	M2III
HD218376	B4III	B0.5IV
HD218804	F3V	F5IV
HD218915	B5I	O9.5Iab
HD219134	K4V	K3Vvar
HD219396	G5IV	G0
HD219396	G5IV	G0
HD219420	F7V	F5
HD219420	G0III	F5
HD219449	K2III	K0III
HD219734	M3III	M2III
HD220182	K0V	K1V
HD220182	G6III	K1V
HD220575	A0I	B8III
HD220825	A3III	A0p...
HD220933	B9III	A0MNp...
HD221354	G6III	K2V
HD221354	G6III	K2V
HD221354	K6II	K2V
HD221354	G6III	K2V
HD221354	G6III	K2V
HD221354	G6III	K2V
HD221354	G5III	K2V
HD221354	G6III	K2V
HD221354	G5III	K2V
HD221585	G6III	G8IV
HD221756	A3V	A1III
HD222404	G5I	K1IV
HD222439	B9III	B9IVn
HD222451	F3IV	F1V
HD222603	A7V	A7V
HD223047	G5I	G5Ib
HD223323	F5II	F2IV-V
HD223385	F7V	A3Ia+...
HD224559	B3I	B4Vne
HD224726	K3III	K0
HD224785	K3III	K0
HD224839	F9V	F8V
HD225160	A3I	O8e

Table 7. Continued.

Star Name	ANN Class	Catalog Class
HD225160	F2I	O8e
HD295354	F0V	A3
HD024098	F0IV	F2
HD027887	F4V	F5
HD032662	F7V	G0
HD084347	G8II	K0
HD111154	F9V	G5
HD115675	K4V	K0
HD118905	K0III	K1III
HD119291	M3II	K7V
HD119291	M1V	K7V
HD121934	G8III	K0
HD122796	G8II	K1III
SUN	G0III	G2V
SUN	F8III	G2V
SUN	F9V	G2V
SUN	G0V	G2V
SUN	G2V	G2V
SUN	G2V	G2V

* from 2001A&A...369.1048P and 2004astro-ph/0409214 (Prugniel and Soubiran).

Parameters measured on the spectra and their Spectral and Luminosity class are given in the:
http://www-obs.univ-lyon1.fr/~prugniel/soubiran/v3/table_meas.dat