

From: "Research Promotion scheme Aicte" <rpsfdc@aicte-india.org>
Subject: Closed RPS Project F. No.- 8-136/FDC/RPS-NER/(Policy-1)/2018-19 dated 14.03.2019
Date: Fri, January 27, 2023 5:02 pm
To: swpatra@tezu.ernet.in
Cc: director.fdc@aicte-india.org,"AD2 FDC" <ad2fdc@aicte-india.org>

Dear Sir/Madam,

Institute Name - Tezpur University, Assam-784028

Your RPS project file no. 8-136/FDC/RPS-NER/Policy-I/2018-19 on dated 14.03.2019 Project titled *"Methods for the Automatic Generation of Attribute Profiles from Hyperspectral Data``.**", **Department of Computer Science & Engineering *is hereby closed.

*सादर अभिवादन**/Regards*

वरुण कोहली/Varun kohli

संकाय विकास प्रकोष्ठ */Faculty Development Cell (FDC),*

अखिल भारतीय तकनीकी शिक्षा परिषद/* All India Council For Technical Education,*

नेल्सन मंडेला मार्ग, वसंत कुंज/* Nelson Mandela Marg, Vasant Kunj,*

नई दिल्ली- 110070/* New Delhi- 110070*

Ph. 011-29581303

Attachments:

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**PROJECT COMPLETION REPORT FOR
RPS PROJECTS**

- File No. : File No. 8-136/RIFD/RPS-NER/Policy-1/2018-19
(as mentioned in sanction letter)
- Date of Sanction : 14/03/2019
- Subject Area : Computer Science & Engineering
1. Principal Investigator : Dr. Swarnajyoti Patra
(Name & address) Dept. of Computer Science & Engineering
Tezpur University,
Napaam, Sonitpur, Assam-784028
 2. Project Title : Methods for the automatic generation of
attribute profiles from hyperspectral data
 3. Total Cost of the Project : Rs. 17, 10, 000.00
 4. Date of Commencement of the Project : 05/04/2019
 5. Duration of the Project : Three years
 6. Date of Completion : 04/04/2022
 7. Objectives of the Project : Hyperspectral images (HSIs) are characterized
by hundreds of bands acquired in contiguous spectral ranges and narrow spectrum intervals. They
represent a rich source of spectral information which can precisely characterize and accurately
recognize the objects on the ground. Over the last decade researchers devoted great effort to
the classification of HSI for numerous applications like urban area management, forest
monitoring, soil moisture estimation, crop monitoring, wetland mapping etc. It has been already
established that the proper exploitation of spatial information along with spectral features
significantly improved the classification accuracy of hyperspectral images. Construction of
attribute profiles is a popular approach widely used for spectral-spatial analysis of hyperspectral
images. The attribute filtering based spectral-spatial profiles constructed so far are dependent on
the threshold values which are detected either manually or automatically. In order to exploits
proper spatial information, the existing techniques are detected a large number of threshold
values that constructed large profiles. As a result, when limited labelled samples are available
(which is common in most of the hyperspectral applications) these techniques are failed to
produce better results due to the curse of dimensionality problem. Moreover, the classification
task becomes computationally demanding. The main objective of this project is to develop few
novel techniques that mitigate the above problems. The outcomes of this project are as follows:

1. Develop some novel techniques that construct smaller profiles by automatically identify few threshold values for attribute filtering which are capable to incorporate maximum spatial information.
2. Develop an attribute filtering technique which would not require threshold value for filtering and could incorporate maximum spatial information by applying few filtering operations.

In both the cases our aim is to construct smaller profiles so that the proposed techniques become also robust when limited labelled samples are available. From methodological point of view, these objectives can significantly improve the state-of-the-art in HSI image analysis by addressing challenging scientific issues. From an applicative perspective, the developed techniques are expected to have a very relevant impact in remote sensing applications.

8. Salient Research Achievements:

- Developed a novel technique that constructs smaller profile by automatically identify few thresholds for attribute filtering which are capable to incorporate maximum spatial information for HSI classification. The detail of this work is available at:

A. Das, K. Bhardwaj, S. Patra and L. Bruzzone, "A novel threshold detection technique for the automatic construction of attribute profiles in hyperspectral images", *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, vol. 13, pp. 1374-1384, 2020.

- Developed a spectral-spatial HSI classification model by combining attribute profiles (generated by the proposed technique) and deep convolution neural networks. The detail of this work is available at:

Das, K. Bhardwaj, and S. Patra, "Deep convolution neural network with automatic attribute profiles for hyperspectral image classification", *Multimedia Tools and Applications*, vol. 80, no. 12, pp. 35665-35685, 2021.

- Developed an attribute filtering technique which does not require threshold value for filtering and incorporate maximum spatial information by applying few filtering operations. The detail of this work is available at:

K. Bhardwaj, S. Patra and L. Bruzzone, "Threshold-free attribute profile for classification of hyperspectral images", *IEEE Transaction on Geoscience and Remote Sensing*, vol. 57, no. 10, pp. 7731-7742, 2019.

8.1 New Findings/Achievements/IPR Potential:

- Few thresholds automatically detected by the proposed technique are enough to capture sufficient spatial information for HSI classification.
- The combination of EAP with 2D or 3D CNN works complimentary to each other and incorporate better spatial information.

- The proposed threshold free profile is more efficient to handle curse of dimensionality problem, as well as computational complexity for HSI classification.

8.2 Product/Process Developed: Under this project the following three classification models are developed

- A model that generates compact profile by detecting suitable thresholds for spectral-spatial HSI classification.
- A model that by combined EAP and deep CNN for spectral-spatial classification of HSI.
- A model that generates attribute profiles without employing threshold parameter for spectral-spatial HSI classification.

8.3 Patent(s) Applied for/Taken, if any : No

8.4 B. Tech. Project / M. Tech Thesis / Ph.D., if any Consultancy : MCA Project – 02
M.Tech Thesis – 01
Ph.D Thesis – 02 (Partially)

- 9 Conclusions Summarizing the Achievements Indicating the Scope for Future Work: The first objective of this project is to develop some novel techniques that construct smaller profiles by automatically identify few thresholds for attribute filtering. Under this project we proposed two novel techniques for the same and both shows their robustness for different datasets. Moreover, for incorporating better spatial information, under this objective, we proposed a hybrid classification model by combining attribute profiles generated by our method and deep CNN.

The second objective of this project is to develop an attribute filtering which would not require threshold value for filtering. Under this project we proposed a novel technique that generate attribute profile of HSI with considering threshold parameter. The profile generated by the proposed technique is small and able to incorporate better spatial information compared to the many state-of-the-art methods.


In our development we always used max-tree and min-tree to generate the filter images. We plan as a future work to study the performance of the proposed methods over different tree representations. A further improvement in the computational time can be achieved by implementing the profile construction in parallel processing environment.


- 10 List of Publications Arising from the Project (please give Author (s), Title, Journal and Year) :

- A. Das, K. Bhardwaj, and S. Patra, "Automatic attribute profiles for spectral-spatial classification of hyperspectral images", In *8th Int. Conf. on Pattern Recognition and Machine Intelligence (PReMI-19)*, Tezpur, India, December 2019.

- K. Bhardwaj, S. Patra and L. Bruzzone, "Threshold-free attribute profile for classification of hyperspectral images", **IEEE Transaction on Geoscience and Remote Sensing**, vol. 57, no. 10, pp. 7731-7742, 2019.
- A. Das, K. Bhardwaj, S. Patra and L. Bruzzone, "A novel threshold detection technique for the automatic construction of attribute profiles in hyperspectral images", **IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing**, vol. 13, pp. 1374-1384, 2020.
- A. Das, K. Bhardwaj, and S. Patra, "Deep convolution neural network with automatic attribute profiles for hyperspectral image classification", **Multimedia Tools and Applications**, vol. 80, no. 12, pp. 35665-35685, 2021.

Dated: 23/06/22


Principal Investigator


Registrar/Director/Principal
(Signature & Seal)

Registrar
Tezpur University
Napaam, Tezpur

FORMAT FOR GENERAL FINANCIAL RULES

(FORM GFR- 19)

Assets acquired wholly or substantially out of Government grants

Register maintained by grantee institution
Block Account maintained by sanctioning authorities
Name of Sanctioning Authority

- | | |
|--|---|
| 1. Serial No. : | TU/11-13/Pur/CSE/2019-20/1983/1984/6074 |
| 2. Name of grantee institution : | Tezpur University, Assam |
| 3. No. and date of sanction : | File No. 8-136/RIFD/RPS-NER/Policy-1/2018-19
Date: 14/03/2019 |
| 4. Amount of the sanctioned grant : | Rs. 15, 10, 000.00 |
| 5. Brief purpose of the grant : | To develop some robust methods for classification of hyperspectral remote sensing images. |
| 6. Whether any condition(s) regarding the right of ownership of Government in the property or other assets acquired out of the grant was incorporated in the grant-in-aid sanction : | No |
| 7. Particulars of assets actually credited or acquired : | Workstation – 01, PC – 05, Laptop – 01, Printer – 01, ENVI software |
| 8. Value of the assets as on: | Rs. 12, 66, 986.00 |
| 9. Purpose for which utilized at present: | Research and development purpose |
| 10. Encumbered or not: | No |
| 11. Reasons if encumbered: | N/A |
| 12. Disposed of or not: No | |
| 13. Reasons and authority, if any, for disposal : | N/A |
| 14. Amount realized on disposal: | N/A |
| 15. Remarks: | |


Registrar/Director/Principal
(Signature & Seal)
Registrar
Tezpur University

RECEIPT & PAYMENT ACCOUNT

(1st April 2019 to 31st March 2020)

Sl.No.	Receipt	Amount (Rs.)	Sl.No.	Payments	Amount (Rs.)
1.	To Opening Balance	0.00	1.	ENVI Software	7,07,438.00
2.	To Grants Received by AICTE	16,90,000.00	2.	Workstation (01), Personal Computers (05), Laptop (01)	5,37,296.00
3.	To Interest (if any)	8,321.00	3.	TA	16,513.00
			4.	Contingency	97,913.00
				Closing Balance	3,39,161.00
	Total	16,98,321.00		Total	16,98,321.00

(Signature of Chartered Accountant)

Name of CA :

Membership No. :

Full Address of CA :

[With seal]

(Signature of Head of the Institute)

Name :

Designation :

Full Address:

[With seal]

Registrar
Tezpur University

(Signature of Finance Officer)

Name :

Designation :

Full Address :

[With seal]

(Govt./Govt. Aided/University & wherever applicable)

Finance Officer
Tezpur University

Dated : _____

RECEIPT & PAYMENT ACCOUNT

(1st April 2020 to 31st March 2021)

Sl.No.	Receipt	Amount (Rs.)	Sl.No.	Payments	Amount (Rs.)
1.	To Opening Balance	3,39,161.00	1.	Printer(01)	22, 252.00
2.	To Grants Received by AICTE	0.00	2.	Contingency	50, 530.00
3.	To Interest (if any)	6,451.00			
				Closing Balance	2,72,830.00
	Total	3,45,612.00		Total	3,45,612.00

(Signature of Chartered Accountant)

Name of CA :

Membership No. :

Full Address of CA :

[With seal]

(Signature of Head of the Institute)

Name :

Designation :

Full Address:

[With seal]

Registrar
Tezpur University

(Signature of Finance Officer)

Name :

Designation :

Full Address :

[With seal]

(Govt./Govt. Aided/University & wherever applicable)

Finance Officer
Tezpur University

Dated : _____

RECEIPT & PAYMENT ACCOUNT

(1st April 2021 to 31st March 2022)

Sl.No.	Receipt	Amount (Rs.)	Sl.No.	Payments	Amount (Rs.)
1.	To Opening Balance	2, 72, 830.00	1.	Contingency	15,044.00
2.	To Grants Received by AICTE	0.00			
3.	To Interest (if any)	6, 445.00			
				Closing Balance	2, 64, 231.00
	Total	2, 79, 275.00		Total	2, 79, 275.00

(Signature of Chartered Accountant)

Name of CA :

Membership No. :

Full Address of CA :

[With seal]

(Signature of Head of the Institute)

Name :

Designation :

Full Address:

[With seal]

Registrar
Tezpur University

(Signature of Finance Officer)

Name :

Designation :

Full Address :

[With seal]

(Govt./Govt. Aided/University & wherever applicable)

Finance Officer
Tezpur University

Dated : _____

RECEIPT & PAYMENT ACCOUNT

(1st April 2022 to 4th April 2022)

Sl.No.	Receipt	Amount (Rs.)	Sl.No.	Payments	Amount (Rs.)
1.	To Opening Balance	2,64,231.00			
2.	To Grants Received by AICTE	0.00			
3.	To Interest (if any)	0.00			
				Closing Balance	2, 64, 231.00
	Total	2, 64, 231.00		Total	2, 64, 231.00

(Signature of Chartered Accountant)

Name of CA :

Membership No. :

Full Address of CA :

[With seal]

(Signature of Head of the Institute)

Name :

Designation :

Full Address: **Registrar**

[With seal] **Tezpur University**

(Signature of Finance Officer)

Name :

Designation :

Full Address :

[With seal]

(Govt./Govt. Aided/University & wherever applicable)

Finance Officer

Tezpur University

Dated : _____


STATEMENT OF EXPENDITURE

File No. : File No. 8-136/RIFD/RPS-NER/Policy-1/2018-19

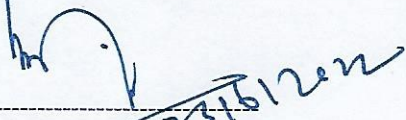
Title of the RPS Project : Methods for the automatic generation of attribute profiles from hyperspectral data.

Name of the P.I. : Dr. Swarnajyoti Patra

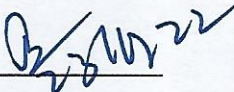
Sanction Order No. & Date	Grant Sanctioned	Details of expenditure Incurred Item wise	Amount Rs. (In each head)	Remarks
File No. 8-136/RIFD/RPS-NER/Policy-1/2018-19 Date: 14/03/2019	Rs. 17, 10, 000.00			Total interest received: Rs. 21, 217.00
	<u>Grant released</u>			
	Rs. 16, 90,000.00			
	Non-recurring: Rs. 15, 10, 000.00	Non-recurring: 1. ENVI Software 2. Workstation (01), Personal Computers (05), Laptop (01) 3. Printer (01)	Rs. 7, 07, 438.00 Rs. 5, 37, 296.00 Rs. 22, 252.00	Balance in Non-recurring head: Rs. 2, 43, 014.00
	Recurring: Rs. 1, 80, 000.00	Recurring: 1. TA 2. Contingency	Rs. 16, 513.00 Rs. 1, 68, 583.00	Balance in recurring head: Rs. - 5, 096.00

(1) 

Signature of PI
with Seal

(3) 
Signature (with Seal) of the Finance Officer/
Auditor/Accounts Officer
(If it is Govt./Govt. Aided Institute)

Finance Officer
Date: **Tespur University**

(2) 

Name and Signature of
Head of Institution with Seal

Registrar
Tespur University

(4) -----
Signature of Chartered Accountant:
Name of Chartered Accountant:
Membership No: Rubber stamp:
Full Address of CA:

UTILIZATION CERTIFICATE
(1st April 2019 to 31st March 2020)

Sanction Letter No. File No. 8-136/RIFD/RPS-NER/Policy-1/2018-19

Date: 16.08.2021

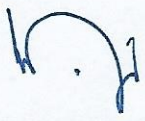
A. NON-RECURRING

Sl. No.	Name of the Equipment Procured	Amount Sanctioned (Rs.)	Amount Utilized (Item wise)	Unspent Balance (Rs.)
1.	ENVI Software	15, 10, 000.00	7, 07, 438.00	2, 65, 266.00
2.	Workstation (01), Personal Computers (05), Laptop (01)		5, 37, 296.00	

B. RECURRING

Sl. No.	Name of the Expenses	Amount Sanctioned (RS.)	Amount Utilized (Rs.)	Unspent Balance (Rs.)
1	TA	1, 80, 000.00	16, 513.00	65, 574.00
2.	Contingency		97, 913.00	

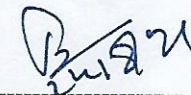
Certified that the grant has been utilized for the purpose for which it was sanctioned in accordance with the "Terms and Conditions" attached to the grant. If, as a result of check or audit objection some irregularity is noticed at a later stage, action will be taken to refund, adjust or regularize the amount objected to



Finance Officer
(Signature & Seal)

Finance Officer
Tezpur University

Dated:



Registrar /Principal/ Director
(Signature & Seal)

Registrar
Tezpur University

Name and Address of the
University/ Institution

AUDITED UTILISATION CERTIFICATE

(1st April 2019 to 31st March 2020)

Certified that out of Rs. **16, 90, 000.00** of Grant-in-aid sanctioned during the year **2019-2020** Letter No. **File No. 8-136/RIFD/RPS-NER/Policy-1/2018-19** Rs. **13, 59, 160.00** has been utilized for the purpose of **the project** For which it was sanctioned and the balance of Rs. **3, 30, 840.00** remaining unutilized at the end of the year, in addition to the amount of Rs. **8, 321.00** on account of interest accrued on grant, will be adjusted towards the Grants – in – aid payable during the next year i.e., **2020-2021** as per the details attached.

Certified that the grant has been utilized as per laid down terms and conditions for which it was sanctioned.



Finance Officer
(Signature and Seal)

Finance Officer
Tezpur University



Registrar/Principal/Director
(Signature and Seal)
Registrar
Tezpur University

Dated:

Chartered Accountant
(Signature and Seal)

UTILIZATION CERTIFICATE
(1st April 2020 to 31st March 2021)

Sanction Letter No. File No. 8-136/RIFD/RPS-NER/Policy-1/2018-19

Date: 16.08.2021

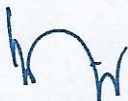
A. NON-RECURRING

Sl. No.	Name of the Equipment Procured	Amount Sanctioned (Rs.)	Amount Utilized (Item wise)	Unspent Balance (Rs.)
1.	Printer	Nil	22, 252.00	2, 43, 014.00

B. RECURRING

Sl. No.	Name of the Expenses	Amount Sanctioned (RS.)	Amount Utilized (Rs.)	Unspent Balance (Rs.)
1.	Contingency	Nil	50, 530.00	15, 044.00

Certified that the grant has been utilized for the purpose for which it was sanctioned in accordance with the "Terms and Conditions" attached to the grant. If, as a result of check or audit objection some irregularity is noticed at a later stage, action will be taken to refund, adjust or regularize the amount objected to



Finance Officer
(Signature & Seal)
Finance Officer
Tezpur University

Dated:



Registrar /Principal/ Director
(Signature & Seal)
Registrar
Tezpur University


Name and Address of the
University/ Institution

AUDITED UTILISATION CERTIFICATE

(1st April 2020 to 31st March 2021)

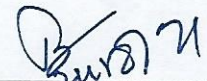
Certified that out of Rs. **3, 39, 161.00** of Grant-in-aid sanctioned during the year **2020-2021** Letter No. **File No. 8-136/RIFD/RPS-NER/Policy-1/2018-19** Rs. **72, 782.00** has been utilized for the purpose of **the project** For which it was sanctioned and the balance of Rs. **2, 66, 379.00** remaining unutilized at the end of the year, in addition to the amount of Rs. **6, 451.00** on account of interest accrued on grant, will be adjusted towards the Grants – in – aid payable during the next year i.e., **2021-2022** as per the details attached.

Certified that the grant has been utilized as per laid down terms and conditions for which it was sanctioned.



Finance Officer *23/8/21*
(Signature and Seal)

Finance Officer
Tezpur University



Registrar/Principal/Director
(Signature and Seal)

Registrar
Tezpur University

Dated:

Chartered Accountant
(Signature and Seal)

UTILIZATION CERTIFICATE
(1st April 2021 to 31st March 2022)

Sanction Letter No. File No. 8-136/RIFD/RPS-NER/Policy-1/2018-19

Date: 08.06.2022

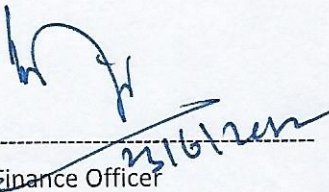
A. NON-RECURRING

Sl. No.	Name of the Equipment Procured	Amount Sanctioned (Rs.)	Amount Utilized (Item wise)	Unspent Balance (Rs.)
1.	Nil	Nil	00.00	2, 43, 014.00

B. RECURRING

Sl. No.	Name of the Expenses	Amount Sanctioned (RS.)	Amount Utilized (Rs.)	Unspent Balance (Rs.)
1.	Contingency	Nil	20, 140.00	-5, 096.00

Certified that the grant has been utilized for the purpose for which it was sanctioned in accordance with the "Terms and Conditions" attached to the grant. If, as a result of check or audit objection some irregularity is noticed at a later stage, action will be taken to refund, adjust or regularize the amount objected to



Finance Officer

(Signature & Seal)

Finance Officer
Tezpur University

Dated:



Registrar /Principal/ Director
(Signature & Seal)

Registrar
Tezpur University

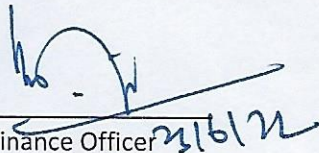
Name and Address of the
University/ Institution

AUDITED UTILISATION CERTIFICATE

(1st April 2021 to 31st March 2022)

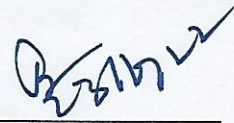
Certified that out of opening balance Rs. 2, 72, 830.00 (Non-recurring Rs. 2, 43, 014.00, Recurring Rs. 15,044.00 and interest Rs. 14,772.00) of Grant-in-aid sanctioned during the year **2021-2022, Rs. 20, 140.00** has been utilized from recurring head for the purpose of the project for which it was sanctioned and the balance of **Rs. - 5, 096.00** need to be reimbursed. In addition to the amount of **Rs. 6, 445.00** on account of interest accrued on grant during the year 2021-22. Thus, a total of **Rs. 2, 64, 231.00** (unutilized non-recurring amount Rs. 2, 43, 014.00 and interest amount Rs. 21,217.00) will be returned to AICTE at the end of the year,

Certified that the grant has been utilized as per laid down terms and conditions for which it was sanctioned.



Finance Officer
(Signature and Seal)

Finance Officer
Tezpur University



Registrar/Principal/Director
(Signature and Seal)

Registrar
Tezpur University

Dated:

Chartered Accountant

(Signature and Seal)

UTILIZATION CERTIFICATE
(1st April 2022 to 4th April 2022)

Sanction Letter No. File No. 8-136/RIFD/RPS-NER/Policy-1/2018-19

Date: 08.06.2022

A. NON-RECURRING

Sl. No.	Name of the Equipment Procured	Amount Sanctioned (Rs.)	Amount Utilized (Item wise)	Unspent Balance (Rs.)
1.	Nil	Nil	Nil	2, 43, 014.00

B. RECURRING

Sl. No.	Name of the Expenses	Amount Sanctioned (RS.)	Amount Utilized (Rs.)	Unspent Balance (Rs.)
1.	Contingency	Nil	Nil	-5, 096.00

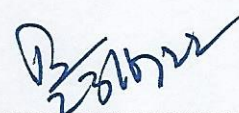
Certified that the grant has been utilized for the purpose for which it was sanctioned in accordance with the "Terms and Conditions" attached to the grant. If, as a result of check or audit objection some irregularity is noticed at a later stage, action will be taken to refund, adjust or regularize the amount objected to



Finance Officer
(Signature & Seal)

Finance Officer
Tezpur University

Dated:



Registrar /Principal/ Director
(Signature & Seal)

Registrar
Tezpur University

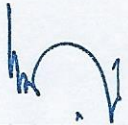
Name and Address of the
University/ Institution

AUDITED UTILISATION CERTIFICATE

(1st April 2022 to 4th April 2022)

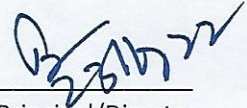
Certified that out of opening balance Rs. 2, 64, 231.00 (non-recurring amount Rs. 2, 43, 014.00 and interest amount Rs. 21,217.00) of Grant-in-aid sanctioned, **Rs. 00.00** has been utilized for the purpose of the project for which it was sanctioned and the balance of **Rs. 2, 64, 231.00** will be returned to AICTE. In addition, a balance of **Rs. - 5, 096.00** in the recurring head need to be reimbursed.

Certified that the grant has been utilized as per laid down terms and conditions for which it was sanctioned.



Finance Officer
(Signature and Seal)

Finance Officer
Tezpur University



Registrar/Principal/Director
(Signature and Seal)
Registrar
Tezpur University

Dated:

Chartered Accountant
(Signature and Seal)